August 1954

MECHANICAL ENGINEERING

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September 8-10, 1954

But why should you care?

You should care because that whistle summons thousands of B&W men who are vital to the country's biggest job.

That job is producing more and more low-cost power with ever greater efficiency.

B&W's contribution consists of building boilers that convert the inert, raw energy found in primary fuels like coal, oil, and gas, to high level, useable energy — steam. Steam is your greatest single source of power, and only a boiler can make it.

A complex, modern boiler is the composite result of unending research, imaginative engineering, highly skilled fabrication, and meticulous erection . . . minds, hands, and machines. Our whistle symbolizes all of these; the brainpower as well as the vast physical plant and facilities that are B&W. In nine modern plants containing some of the largest and most powerful equipment of its type, B&W craftsmen utilize skills born of unparalleled experience to transform the accomplishments of research and engineering into some of the most efficient boilers in the world.

B&W's physical growth has matched the huge growth of its job. But even more important is the vast store of knowledge and experience accumulated throughout almost 90 years of manufacturing steam generators. Experience such as this, applied to the problems of steam technology, is quickening the pace of universal progress.

BABCOCK & WILCOX

BOILER DIVISION

N-184

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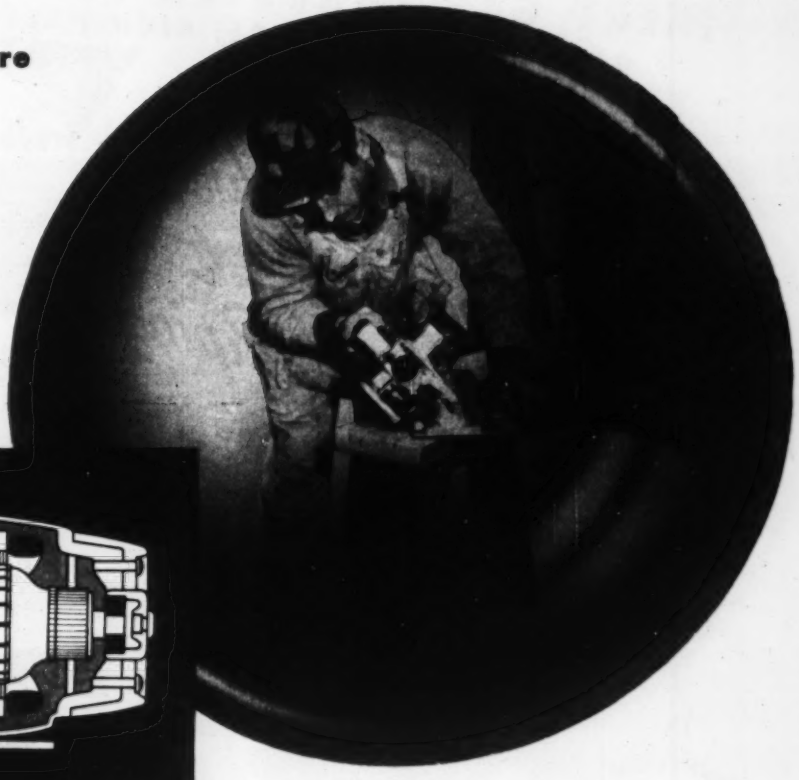
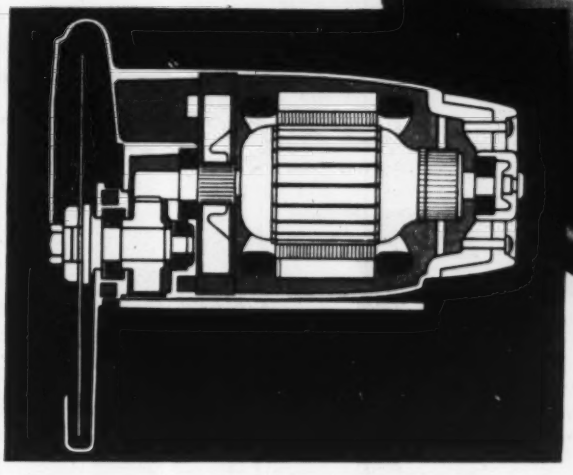
New Departures assure smooth, high-speed operation for Porter-Cable tools!





Four New Departure **ball** bearings in Porter-Cable's No. 115 saw contribute importantly to its dependable, trouble-free operation.

Long hours of heavy work without letup! New Departure precision **ball** bearings help keep Porter-Cable's No. 115 saw on the job. These bearings preserve alignment of moving parts under all conditions . . . require almost no upkeep . . . assure smooth, clean cutting and a cool-running motor for hours on end.

New Departure **ball** bearings bring advantages like these to hundreds of machines and appliances. Whether improving a product or designing a new one, *talk with your New Departure engineer.* He'll help you get maximum efficiency and economy in bearings.

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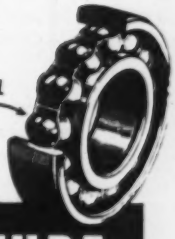

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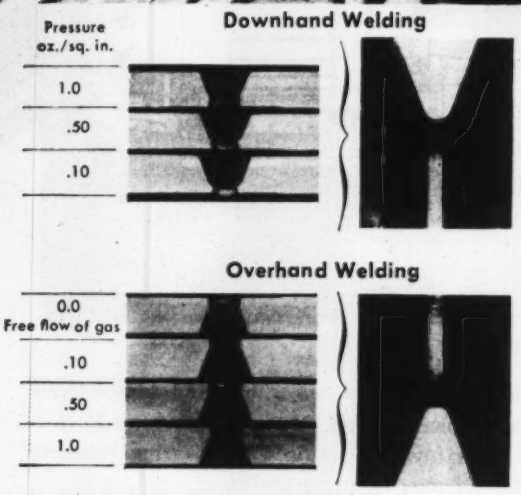
INERT GAS TUNGSTEN ARC-WELDING
ON HIGH-TEMPERATURE, HIGH-PRESSURE PIPING

It's a Standard Production Procedure at Pittsburgh Piping

Inert gas tungsten arc-weld root pass on 2¼% Chrome–1% Moly steel turbine connection for 1000°F service.



Slight variations in internal inert gas pressure make great differences in contour of root pass. Skill of operator and welding groove details are of greater importance than gas pressure.

Inert gas tungsten arc-welding is a technique which has been long and successfully applied to high-temperature, high-pressure piping at P.P.&E. Used for the first pass, it eliminates need for backing rings and double butt welding, assures full penetration and fusion, and produces a joint having a smooth inner contour that requires no grinding.

Pittsburgh Piping's process provides an inert gas shield on both external and internal surfaces of the root pass. This complete protection against oxidation results in an outstandingly uniform inside bead.

The success of the inert gas tungsten arc-welding process hinges on the welder's skill, and correct application of the many other fabricating techniques developed by Pittsburgh Piping.

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PP-4

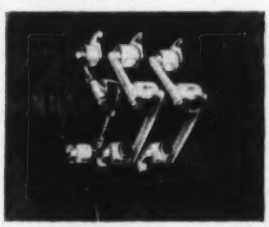
Chiksan Aero-Hydraulic Swivel Joints Chosen by North American

Chiksan aero-hydraulic swivel joints and assemblies convey hydraulic power through the complicated folding wing area of this sleek navy fighter. Flexible as rubber with the strength of steel, these swivel joints flex in a predetermined arc, avoiding the possibility of entangling lines.

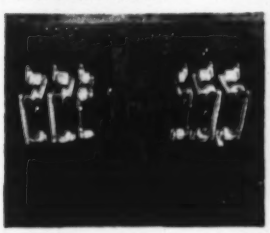
By eliminating the tubing and providing a single forged unit in this 3000 psi system, Chiksan saves in space and assembly time with the added assurance of absolute safety in control performance by removing eight possible points of leakage.

For these reasons, North American, world's largest builder of military aircraft, has joined the roster of famous air-frame manufacturers employing Chiksan swivel joints and assemblies.

Chiksan swivel joints and assemblies permit the wings to be folded for aircraft carrier storage.



When wings are in the horizontal position, the joints form solid lines carrying hydraulic fluids.



Chiksan assemblies provide a fixed arc of travel, allowing a compact grouping of duplicate sets of lines.

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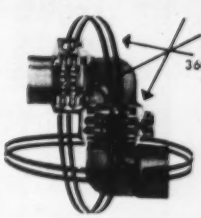
Ball-Bearing Swivel Joints

THE NEW TOOL OF MODERN INDUSTRY



CHIKSAN Ball Bearing Swivel Joints are THE NEW TOOL of Modern Industry with full 360° rotation in 1, 2, and 3 planes. Over 1,000 different types, styles, and sizes have been developed for pressures and services from 28" vacuum to 15,000 psi and for temperature ranges from minus 70° to plus 500° F. with packing materials for each specific service.

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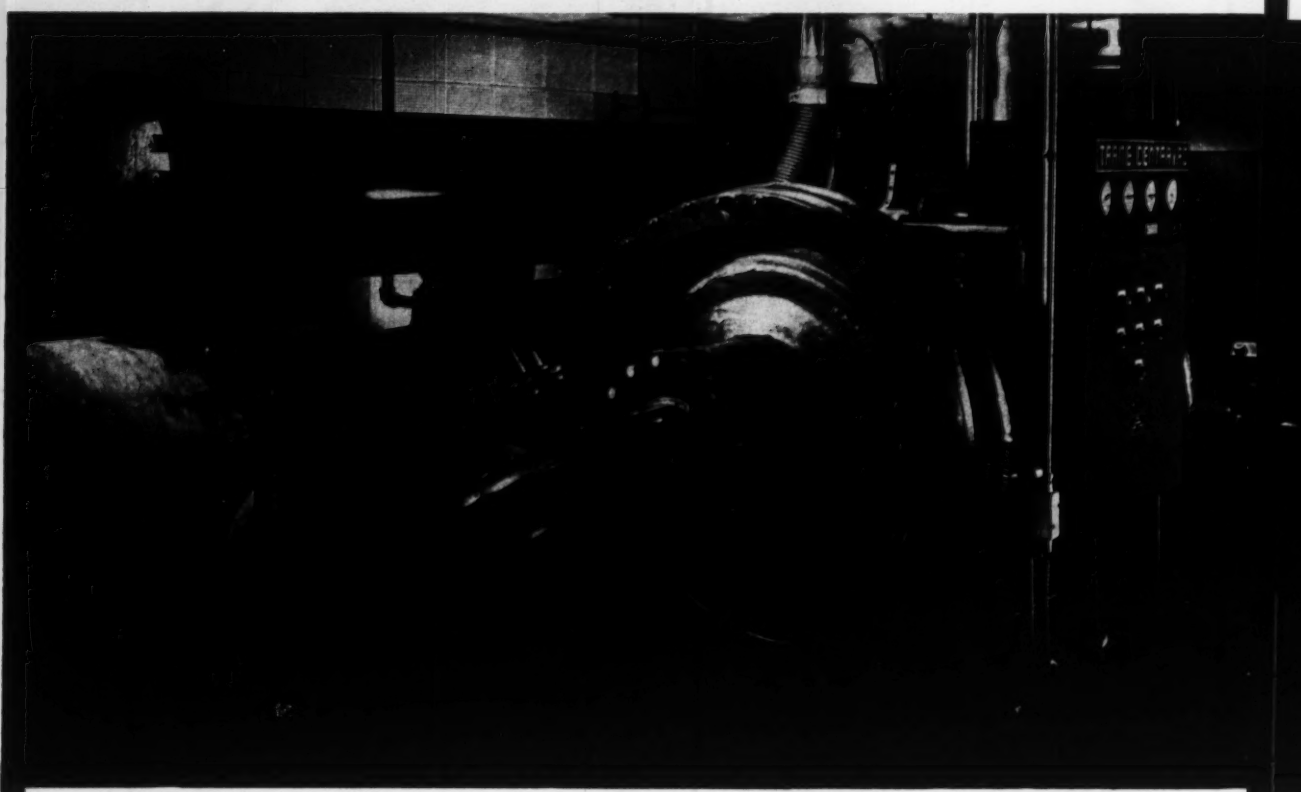
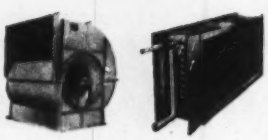
New hermetic centrifugal compressors boost water chilling equipment in new sizes and types provides

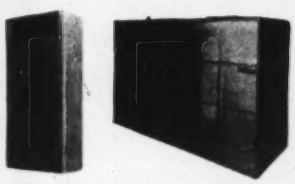


Trane Evaporative Condenser. Use where water is scarce or expensive. Cuts water consumption as much as 90%.

Trane Multi-Zone Climate Changer. Air conditions up to 6 zones at once — each zone can have different conditions. 450 to 23,400 cfm.



Trane Fans and Coils. Fans, Class I and II, backwardly inclined or forward curved. Coils for steam, hot water, cold water or direct expansion refrigerants.

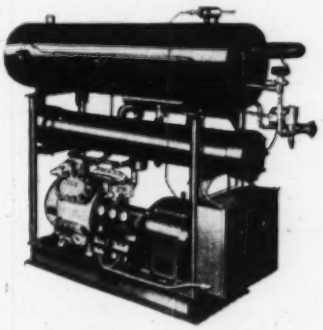


Trane Self-Contained Units. 3 to 20 tons. Heating coil optional. Built-in evaporative condenser optional with 10, 15, 20-ton units.

3 new sizes air conditioning jobs!

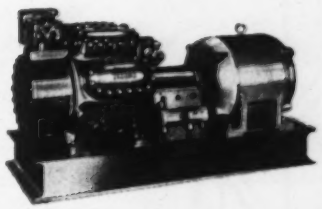
capacity up to 400 tons . . . Other Trane air conditioning increased design flexibility

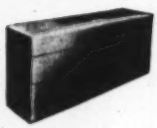
CenTraVac Water Chiller in 3 new sizes tops the list of TRANE air conditioning equipment that has been widened again to enable you to design more efficiently, more economically than ever! CenTraVac single-unit capacities now range from 45 to a maximum of 400 tons. Hermetic centrifugal refrigeration unit completely self-contained. Starts, stops, modulates automatically. Lets you design systems that adjust automatically to varying cooling needs with power savings almost directly proportional to load variations. Requires no special bases.



4 New Cold Generator sizes—30, 60, 75 and 100 tons—expanded line now provides water chilling capacities from 10 to 100 tons. Complete refrigeration cycle . . . factory engineered, assembled, tested, guaranteed. A single unit, wired, piped and refrigerant-charged. Includes condenser, refrigerant piping, liquid cooler, control valves, motor and accessories. Only simple plumbing and electrical hook-up required.

3 New Reciprocating Compressor units—60, 75 and 100 tons—extend the line from 10 to 100 tons. TRANE compressors are smoother, quieter, longer-lasting. Maximum performance in minimum space. Direct drive. Factory-assembled. Easy to install. Automatically modulate capacity to match variations in cooling demand, slash power consumption. Available with shell-and-tube condenser.





Trane UniTrane room units use chilled or hot water. Individual control. Free-standing, recessed or ceiling models.

What kind of system are you planning? Large . . . small? Simple, complex? Cooling only or a complete air conditioning installation? Enjoy advantages of undivided responsibility and a single source of supply by specifying TRANE equipment. Before you plan your next job, get all the facts on complete TRANE line. Contact your TRANE Sales Engineer or write TRANE, La Crosse, Wis.

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Here's why the Ljungstrom saves fuel...improves boiler performance

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2. **Increases Boiler Output** — Preheating combustion air increases boiler furnace temperature. Heat absorption into boiler tubes increases at the same time, raising the unit's capacity to produce steam.

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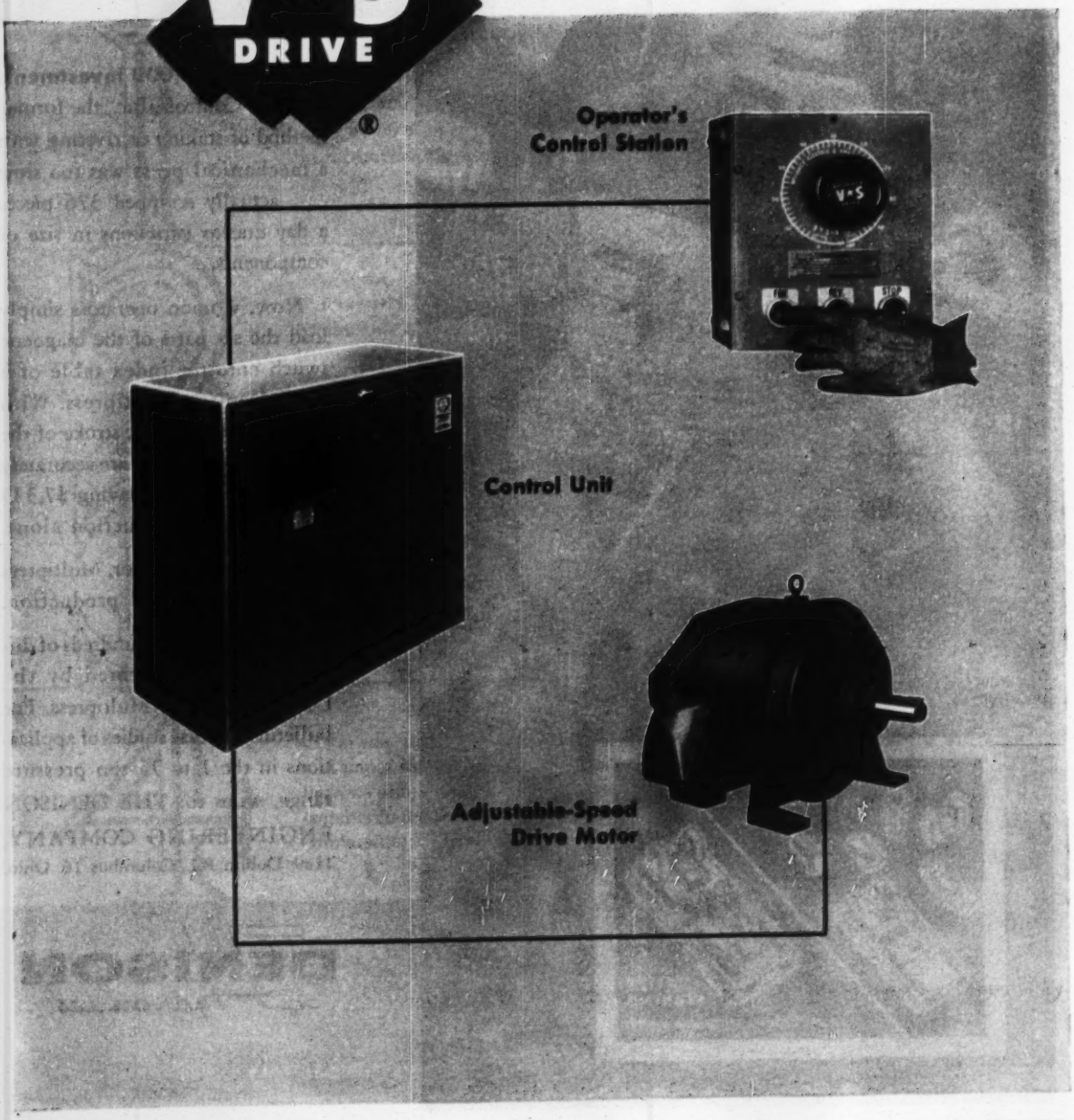

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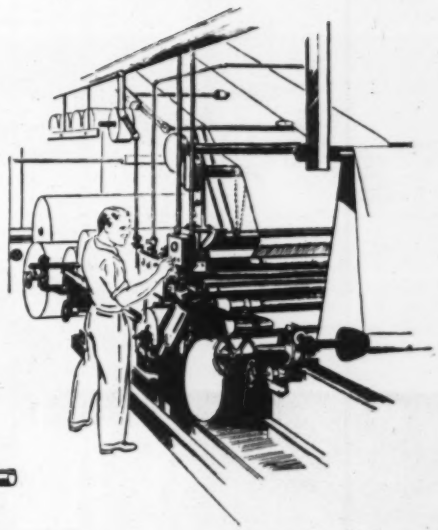

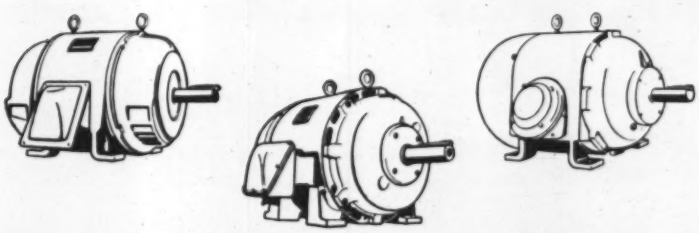

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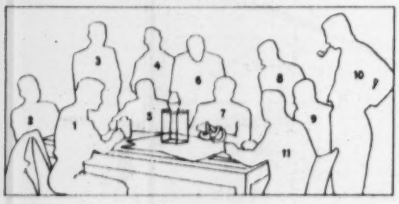

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To insulate outdoor tanks with complete weather protection, these skilled J-M applicators follow a specification developed by Johns-Manville. Here they are fastening J-M Asbestocite* Sheets over J-M Zerolite* Insulation. J-M 85% Magnesia Insulation is also widely used for this type of equipment

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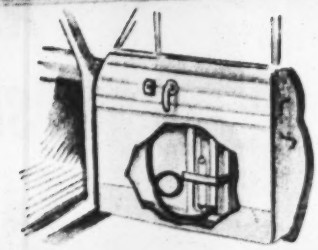

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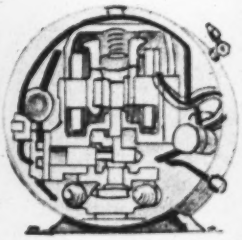
FRAME FOR OCCASIONAL TABLE

REFRIGERATOR COMPRESSOR LINES



REMARKS Do you have a tubing design that won't jell -- or a fabrication kink you can't untangle? Whatever your tubing headache, why not turn it over to our engineering experts. They offer you years of problem-solving experience, plus the added bonus of Bundyweld, the only tubing double-walled from a single strip (see below).

WRITE today for catalog or for help in developing your tubing ideas.

BUNDY TUBING COMPANY
DETROIT 14, MICHIGAN

SUPERMARKET PUSHCART FRAME

WHY BUNDYWELD IS BETTER TUBING

Bundyweld starts as a single strip of copper-coated steel. Then it's . . .

continuously rolled twice around laterally into a tube of uniform thickness,

and passed through a furnace. Copper coating fuses with steel. Result . .

Bundyweld, double-walled and brazed through 360° of wall contact.

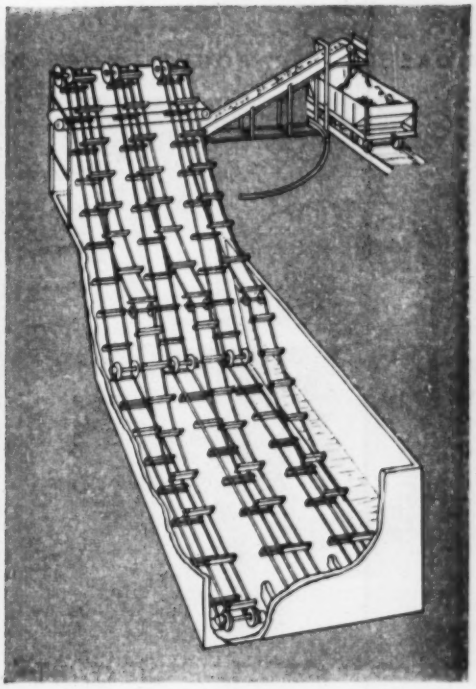
BUNDYWELD TUBING®

DOUBLE-WALLED FROM A SINGLE STRIP

Leakproof
High thermal conductivity
High bursting point
High endurance limit
Extra-strong
Shock-resistant
Ductile

Lightweight
Machines easily
Takes plastic coating
Takes plating
Bright and clean
No inside bead
Uniform I.D., O.D.

Bundy Tubing Distributors and Representatives: ***Bridgeport, Conn.:*** Korhumel Steel & Aluminum Co., 117 E. Washington St. • ***Cambridge 42, Mass.:*** Austin-Hastings Co., Inc., 226 Binney St. ***Chattanooga 2, Tenn.:*** Peirson-Deakins Co., 823-824 Chattanooga Bank Bldg. • ***Chicago 32, Ill.:*** Lapham-Hickey Co., 3333 W. 47th Place • ***Elizabeth, New Jersey:*** A. B. Murray Co., Inc., Post Office Box 476 • ***Los Angeles 58, Calif.:*** Tubesales, 5400 Alcoa Ave. • ***Philadelphia 3, Penn.:*** Rutan & Co., 1717 Sansom St. • ***San Francisco 10, Calif.:*** Pacific Metals Co., Ltd., 3100 19th St. • ***Seattle 4, Wash.:*** Eagle Metals Co., 4755 First Ave., South • ***Toronto 5, Ontario, Canada:*** Alloy Metal Sales, Ltd., 181 Fleet St., E.
Bundyweld nickel and Monel tubing are sold by distributors of nickel and nickel alloys in principal cities.



Up to 475 tons of steel mill scale are recovered per week by this Link-Belt equipment. As scale from steel strip settles to tank bottom (see diagram), three Straightline Collectors move it up incline. Cross belt conveyor carries it to pivoted belt conveyor for discharge to railroad cars.

Link-Belt equipment helps end stream pollution—

Recovers valuable by-products from industrial wastes

BEFORE this steel mill installed Link-Belt Straightline Collectors, almost half of its mill scale was literally "going down the drain" . . . and frequently clogging the sewers. Now it recovers an extra 225 tons a week—72% pure iron. What's more, the waste water is clearer than the river water into which it flows.

Many other industries—including railroads, packers, canners—have found that calling in Link-Belt to clean up their liquid waste frequently pays a profit. Link-Belt engineers have broad experience—not only on industrial waste—but on sewage and water treatment as well. They'll work with your own engineers, chemists and consultants—help you get the finest in modern treatment equipment.

Sanitary engineering is just one facet of Link-Belt's relationship with industry. You'll find Link-Belt materials handling, processing and power transmission products at work in almost every industry. Next time you need conveying or drive equipment—from a single length of chain to a complete system—depend on Link-Belt.

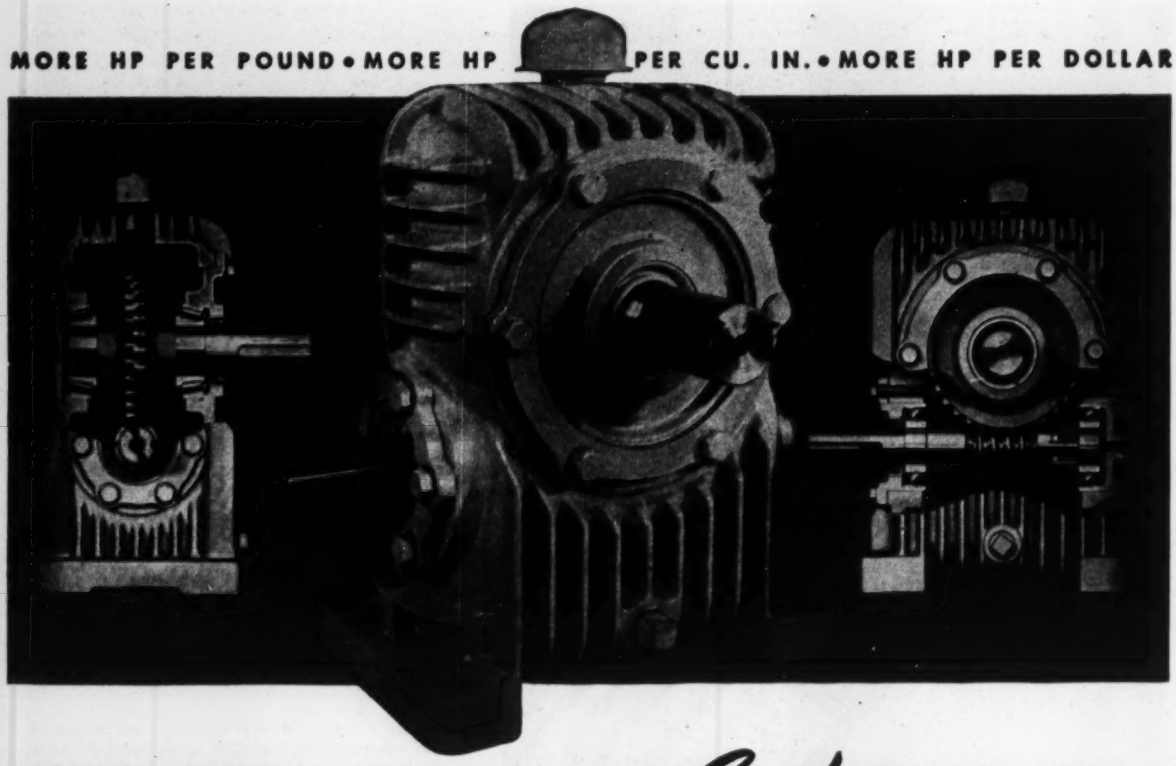
To arrange an immediate consultation with a Link-Belt waste disposal specialist, call your nearby Link-Belt office or write LINK-BELT COMPANY, Dept. AV, 307 N. Michigan Avenue, Chicago 1, Illinois. 13.565

LINK-BELT

One source . . . one responsibility for materials handling and power transmission machinery

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

MORE HP PER POUND • MORE HP PER CU. IN. • MORE HP PER DOLLAR



190,000 STANDARD *Stock* ANSWERS TO *Your* DRIVE PROBLEMS

Look closely at the cutaway views above. Note how the worm wraps around the gear and the gear around the worm. That's the double-enveloping principle of Cone-Drive gears. It gives you high load-carrying capacity, long life and less weight, all in an extremely compact unit.

Size for size, Cone-Drive speed reducers will out-perform any other worm geared speed reducer on the market.

Yet, you can select any one of 190,000 standard stock reducers to solve your specific drive problem the efficient way.

You can choose ratios from 5:1 to 4900:1.

You can handle loads from fractional to 800 hp.

You get all this with only 58 standardized mountings.

Cone-Drive gears offers this versatility because of their modern manufacturing methods. All parts for a given center distance—gears. mountings, bearings, housings, fan-cooling attachments and water cooling coils, etc.—are standardized whether you require worm under or over, gear shaft vertical or horizontal, single or double-extended shafts, right or left hand. All of these parts are completely interchangeable for a given center distance, too.

Find out more about Cone Drive speed reducers. Ask for Bulletin 8901-50.

CONE-DRIVE GEARS

DOUBLE ENVELOPING GEAR SETS & SPEED REDUCERS

Division, Michigan Tool Company

7171 E. McNichols Road • Detroit 12, Michigan

Remember the trade marks "tt" and "TUBE-TURN" are applicable only to products of TUBE TURNS.

Engineered for tough service

TUBE-TURN CONCENTRIC REDUCERS provide a gentle transition from large to small diameters with strong knuckle contours. They exceed the pipe itself in bursting strength and have fatigue strength equal to that of the joining butt weld.

This extra quality at no extra cost is typical of the entire Tube Turns' line. You can specify TUBE-TURN Welding Fittings and Flanges and *know* that you will get the *exact* answer to your specific piping problem. This leading line includes more than 4000 items in all piping materials, schedules and sizes to match *your* design . . . available promptly through your nearby Tube Turns' Distributor.

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A Division of National Cylinder Gas Company

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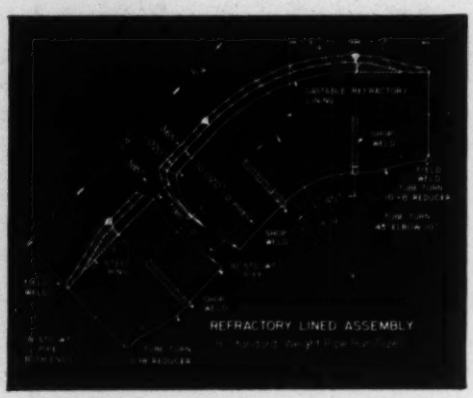
YOUR PIPING PROBLEM?
Here's service to help you...

TUBE TURNS' Engineering Service Division is staffed with men of wide experience to help solve your piping problems. Typical of many they encounter is this:

The general practice in handling highly abrasive materials in piping is to use heavy wall carbon steel elbows for directional changes, and replace these as they wear out. Recently, a new pipe lining . . . a zirconia-corundum refractory . . . was introduced with exceptional wear-resistant properties. This offers a highly satisfactory solution to the abrasion problem. The sketch shows how this lining can be applied to a 45° elbow by combining with two reducers.

This application is practical for piping of 4" through 12" diameter. Minimum thickness for casting of refractory is about one inch. It should be confined to mild pressure-temperature conditions. Additional details are available from Tube Turns' Engineering Service Division.



Design of 45° directional change with refractory-lined elbow.

TUBE TURNS, Dept. F-4
224 East Broadway, Louisville 1, Kentucky

Please send free copy of booklet on Stainless Steel Piping.

Company Name _____

Company Address _____

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Your Name _____

Position _____

YOUR SIZE: These ½-inch and 42-inch TUBE-TURN Welding Elbows are the extremes in the range of diameters available out of stock in carbon steel. Tube Turns' complete line of more than 4000 items includes fittings and flanges in carbon steels, stainless steels, chrome-moly steels, copper, aluminum, brass, monel metal, nickel and wrought iron.

YOUR SOURCE: The nearby Tube Turns' Distributor provides prompt delivery of TUBE-TURN Welding Fittings and Flanges to meet your needs exactly. He acts as your warehouse. He cuts your purchasing red-tape and time. He is backed up by the entire Tube Turns' organization.

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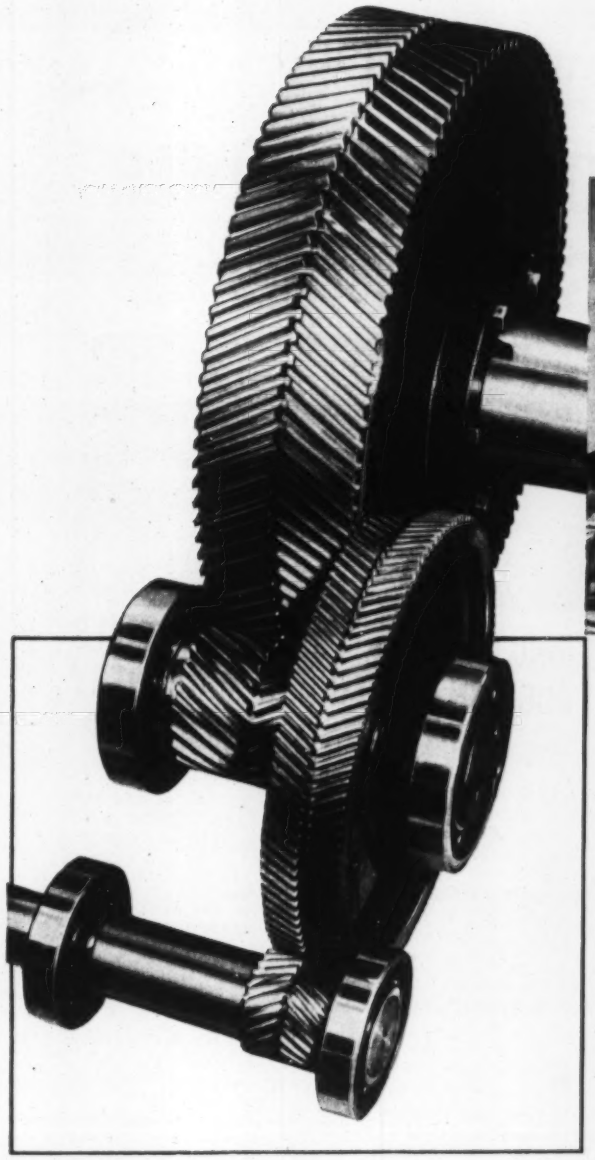
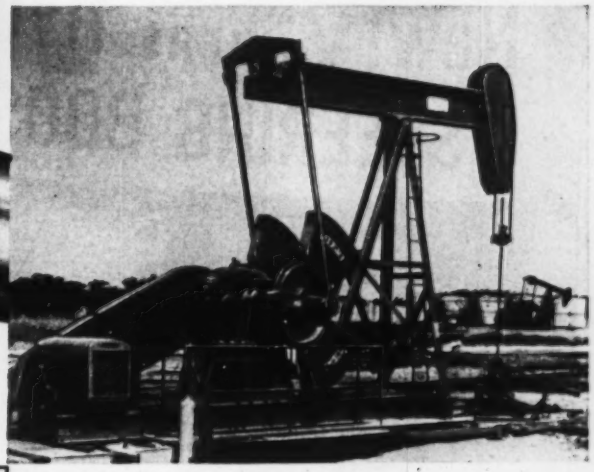
"TT" and "TUBE-TURN" Reg. U.S. Pat. Off.

TUBE TURNS
A DIVISION OF NATIONAL CYLINDER GAS COMPANY
LOUISVILLE 1, KENTUCKY

FLOATING ON HYATTS!





This is a job for straight roller bearings, and EMSCO relies on HYATTS!

Take a good look at these herringbone gears—and at the four bearings supporting the two smaller shafts. These particular herringbones operate in the gear box of EMSCO's newest pumping unit, and the bearings are *Hyatt Hy-Loads!* For oilmen, this is a combination that means longer bearing life and lower maintenance costs, because only *straight radial bearings* permit these gears to locate themselves for most efficient operation. And when the application calls for radial-type bearings, EMSCO engineers specify Hyatts. Hyatts offer the proven advantages of easy assembly, simple maintenance, complete interchangeability of parts, and longer life. Insist on Hyatt Hy-Load Bearings for herringbone gear applications.

HYATT ROLLER BEARINGS

STRAIGHT ○ BARREL ○ TAPER ○

HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION • HARRISON, NEW JERSEY

HYDRAULICS FOR MOBILE EQUIPMENT

VOL. 2

Mobile Equipment News

VICKERS INCORPORATED, DETROIT, MICHIGAN

IMPROVES PERFORMANCE • CUTS COSTS

NO. 5

New! VICKERS® HYDRAULIC POWER STEERING BOOSTER...SERIES S23

LATEST DEVELOPMENT in POWER STEERING for TRUCKS, BUSES, MATERIALS HANDLING VEHICLES, ROAD CONSTRUCTION and MINING MACHINERY

More compact . . . improved in operating characteristics . . . this new Vickers Steering Booster, Series S23 is an important new development in power steering for many vehicles. Application is much easier because it requires less space . . . and ultimate costs are substantially lower. Series S23 thus opens the way to fingertip ease of steering for a wide range of additional vehicles.

Like the preceding models, Series S23 has hydraulic lock against road shock. Bumps, chuckholes, blown front tires, obstructions, etc., cannot spin the steering wheel or jerk it out of control. This is a safety factor of great importance.

In the interest of better operation and as a logical design improvement, the integral relief valve has been omitted from Series S23 and combined with a volume control valve. Vickers VT16 and VT17 pumps have integral volume control and relief valves. Where larger pumps are required, a separate combination valve is used (see Series FM2 below).

ASK FOR NEW BULLETIN M5106

MORE VERSATILE INSTALLATION

In Series S23 Boosters, the servo ball stud housing is symmetrical, and can be assembled in any one of four positions. This and the compactness of the Booster makes application easier . . . increases the number of applications which can be made without major engineering changes. Series S23 Booster may be mounted interchangeably with Series S6-270 Booster, however a relief valve must be provided either by use of VT16 or VT17 pumps or Series FM2 volume control and overload relief valve.

REQUIRES LESS SPACE

The new booster has been reduced in size by the redesign of the servo control valve. The tube connecting the servo valve to the rod end has been relocated and is now on the same side as the fitting connection. As a result of these changes, Series S23 requires less space . . . works in closer quarters.

6795

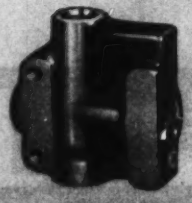
VICKERS Incorporated

DIVISION OF THE SPERRY CORPORATION

1500 OAKMAN BLVD. • DETROIT 32, MICH.

Application Engineering Offices: ATLANTA • CHICAGO AREA (Brookfield) CINCINNATI • CLEVELAND • DETROIT • HOUSTON • LOS ANGELES AREA (El Segundo) • NEW YORK AREA (Summit, N. J.) • PHILADELPHIA AREA (Ardmore) • PITTSBURGH AREA (Mt. Lebanon) • ROCKFORD • SAN FRANCISCO AREA (Berkeley) • SEATTLE • TULSA WASHINGTON • WORCESTER

VICKERS® VOLUME CONTROL and OVERLOAD RELIEF VALVE

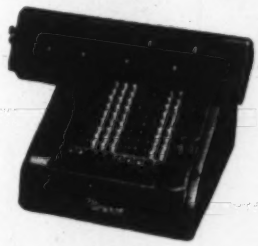


Five sizes of Series FM2 Valves were developed primarily for hydraulic power steering on trucks, buses and materials handling equipment where the pump does not include a volume control valve. The FM2 improves steering booster performance by providing a relatively constant volume of oil regardless of engine speed variations. An integral relief valve is included.

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

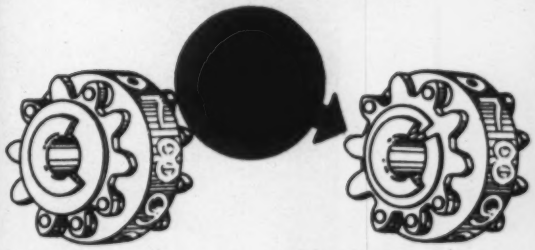
Waldes Truarc rings replace old-fashioned fasteners... save assembly time...end scrap loss...increase operating efficiency

This is the Monroe Calculator



...precision-engineered business machine made even more efficient, and less costly to manufacture through the use of Waldes Truarc Retaining Rings.

Multiplier Dial Assembly



Old Way. One-piece assembly was spun together. Spinning operation was costly, resulted in high scrap loss.

Truarc Way. Two-piece assembly is held together by one Truarc Ring (series 5108). Rejects: practically zero.

Electric Motor Governor

Old Way. Collector Disc assembly was formerly riveted, requiring skilled labor. Riveted Collector Disc could not be removed in the field.

Truarc Way. Truarc Ring (series 5100) replaces rivets, saves labor, material...improves Collector action. Collector Disc is easily replaced.

Intermediate Gear Shaft

Old Way. Washer riveted on end of assembly for zoning control. Costly, troublesome, hard to obtain critical zoning required.

Truarc Way. Truarc E-Ring (series 5133) cuts assembly time, virtually eliminates rejects and final assembly and zoning problems.

Monroe Calculating Machine Company, Orange, N. J. uses various types and sizes of Waldes Truarc Retaining Rings. Use of Truarc has helped eliminate scrap losses, saved on material and labor, and resulted in increased operating and servicing efficiency of the product. Monroe plans to use Truarc Rings for every possible fastening operation on their entire line!

You, too, can save money with Truarc Rings. Wherever you use machined shoulders, bolts, snap rings, cotter pins, there's a Waldes Truarc Retaining Ring designed to do a better, more economical job. Waldes Truarc Rings are precision-engineered...quick and easy to assemble and disassemble.

Find out what Waldes Truarc Retaining Rings can do for you. Send your blueprints to Waldes Truarc Engineers for individual attention, without obligation.

SEND FOR NEW CATALOG

WALDES

TRUARC

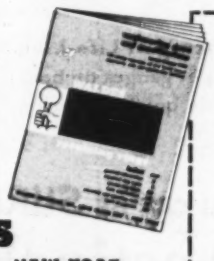
REG. U. S. PAT. OFF.

RETAINING RINGS

WALDES KOHINOOR, INC., LONG ISLAND CITY 1, NEW YORK

WALDES TRUARC RETAINING RINGS AND PLIERS ARE PROTECTED BY ONE OR MORE OF THE FOLLOWING U. S. PATENTS: 2,382,947; 2,382,948; 2,416,882; 2,420,921; 2,420,241; 2,439,785; 2,441,540; 2,459,155; 2,483,300; 2,483,303; 2,487,992; 2,487,993; 2,491,306; 2,509,081 AND OTHER PATENTS PENDING

For precision internal grooving and undercutting...Waldes Truarc Grooving Tool!



ME 086

Waldes Kohinoor, Inc., 47-16 Austel Pl., L. I. C. 1, N.Y.

Please send me the new Waldes Truarc Retaining Ring catalog.

(Please print)

Name .....

Title .....

Company .....

Business Address .....

City ..... *Zone* ..... *State* .....

The Dana Warp Mills took advantage of Life-Line Gearmotors' compactness and operating efficiency. Shown is a Life-Line Gearmotor driving a delivery roll on a slasher.

Close-Quarter Servicing No Problem when your drive is a Westinghouse Gearmotor

Powering equipment at the Dana Warp Mills meant putting compact and dependable drive units into cramped quarters. To meet space limitations, designers carefully selected gearmotors with minimum size and definite servicing advantages . . . they specified Life-Line Gearmotors.

Integral design of Life-Line Gearmotors provides maximum saving in space and means no intricate coupling or alignment problems.

Inspection and servicing of Life-Line Gearmotors is simple. Sight gauges on both sides of gear case enable quick detection of oil level. The gear case is split horizontally and by removing a few bolts, the gear cover can be lifted clear of the unit. This simple operation makes all working parts accessible without draining oil or disturbing the unit mounting. Machine alignment remains true.

Life-Line* motor features and tough, precision-made Westinghouse gears combine to give Life-Line Gearmotors lasting stamina, even on the most rugged jobs.

For detailed information, write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-07323

*Trade-Mark

YOU CAN BE SURE... IF IT'S Westinghouse

When some brick sell for as little as 10¢ each . . .

Why is this brick worth $1.70?

Suppose you put a muffle arch of these $1.70 brick in a furnace and — as a direct result — *doubled productive capacity*. Suppose you put them in the floor of another and it *lasted 50 times longer*. Suppose you put them in the hearth of a third and *eliminated 30 days downtime* in one year. Then at $1.70 apiece these brick would be a terrific buy. And are. Because these figures come from real, live companies! Companies that replaced ordinary refractories with CARBORUNDUM's super refractories!

Granted, you can't always get such spectacular results. But you usually get a combination of benefits. For example, by lasting longer, CARBORUNDUM's refractories automatically cut costly downtime losses . . . and maintenance expense . . . and labor. And by using heat more efficiently, you not only increase production . . . but cut fuel costs . . . and cut rejects. In short, their value is more — much more — than just to resist heat.

So if you could use a material that is far harder than metals . . . or one that conducts heat nearly as rapidly as chrome-nickel steel . . . or another that insulates well at temperatures above 3000 F — we have them. These "man-made minerals" range from a ceramic fiber (looks like cotton), to a superdense refractory that's cast, like a metal. And our engineers can show you how to combine these materials to exploit their complete range of properties.

WHY NOT CHECK UP? It's smart to at least know what super refractories *can do*. This coupon is your private introduction.

CARBORUNDUM

Registered Trade Mark

Dept. P-86, Refractories Division
The Carborundum Co., Perth Amboy, N. J.

☐ Please send complimentary descriptive booklet.
☐ I'd like to talk with one of your engineers.

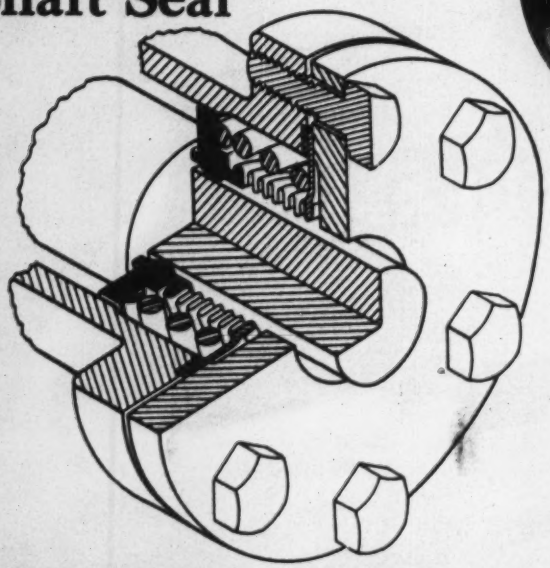
Name _____ Position _____

Company _____

Address _____

_____

How To Design A Bellows Type Shaft Seal



BELLOWS SHAFT SEAL ASSEMBLY is mechanically attached and sealed to shaft housing on one end. Seal nose at other end bears against shoulder on rotating shaft. The bearing surface of seal nose can be superfinished. Thrust is maintained by spring-action of the bellows, backed up by loading spring and remains constant regardless of pressure changes. Result: power output of shaft does not vary with pressure changes within the system. Wear occurs at an even, low rate. No tightening or take-up is required for the life of the seal.

Advantages of Bellows Seals

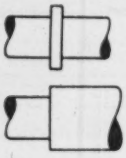
Pressure Problems Metallic bellows shaft seals have a long history of successful application in sealing shafts operating under fluid pressure conditions. A common example is their use in sealing the pump shafts of high pressure refrigeration systems.

By designing the seal nose and bellows to have equal effective areas, the thrust of the seal against the shaft face will remain constant and at a low value. Changes in internal or external pressures have no effect on the power output of the shaft and a tight seal is maintained.

Temperature Applications The all-metallic construction of bellows shaft seals make them effective over wide temperature ranges. In aircraft applications, bellows type seals operate under temperature extremes of —20F to 165F in pump shaft service. Even greater temperature ranges than these pose no problems for bellows shaft seals since they are not subject to deterioration due to heat and cold.

Shock, Vibration, Misalignment problems are frequently overcome by these seals because the bellows are inherently flexible and when a back up spring is incorporated in the design, they are ideal for such heavy duty applications as sealing torque converter shafts on trucks, military tanks and other large equipment operating under severe load conditions.

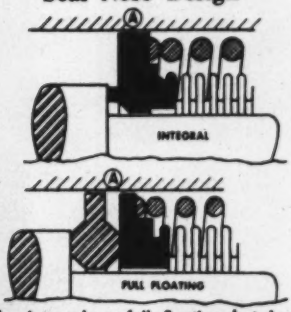
Corrosion Bellows shaft seals made of corrosion resistant metals such as stainless steels, monel, etc., greatly minimize corrosion problems. Several major manufacturers use them for sealing the shafts of gasoline and fuel pumps.



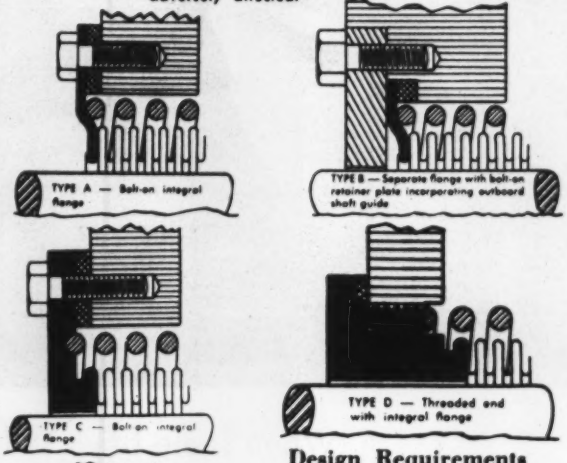
Shaft Preparation

The shaft to be sealed may either be turned down to provide a face for the seal nose to bear against, or a built-up ring may be provided. In either case the shaft face should be suitably finished for the intended service. (7.4.12)

Seal Nose Design

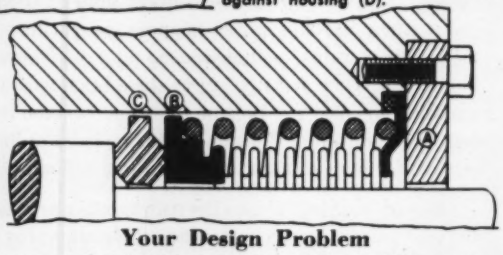


Seal nose can be integral or full floating but in either case guide the nose piece from the stationary member (shaft housing) as shown at (A). Full-floating design is best. It is poor practice to guide seal nose from shaft since vibration will be transmitted to bellows and life and efficiency of seal will be adversely affected.


TYPE A — Bolt-on integral flange
TYPE B — Separate flange with bolt-on retainer plate incorporating outboard shaft guide
TYPE C — Bolt-on integral flange
TYPE D — Threaded end with integral flange
TYPE E — Separate threaded flange

Design Requirements

The outboard end of the shaft seal must always be fastened rigidly to the stationary shaft housing and gasketed leak tight. Bellows should never be allowed to rotate with the shaft. Composite of good practice (below) shows use of an outboard shaft guide (A), nose piece guided against stationary housing (B) and use of full floating seal nose — also guided against housing (D).



Your Design Problem

If you are faced with a shaft sealing problem, you can get help direct from Clifford. Simply sketch the controlling dimensions, types of seal ends desired and service conditions to be met. We will recommend a design to meet your requirements and produce seals in any quantity.

Write: Clifford Manufacturing Company. 144 Grove Street, Waltham 54, Massachusetts. *Division of Standard Thomson Corporation.* Sales Offices in New York, Detroit, Chicago, Los Angeles and Waltham, Mass.

Emphasize the Engineering Advantages of Irving Bridge Decking.

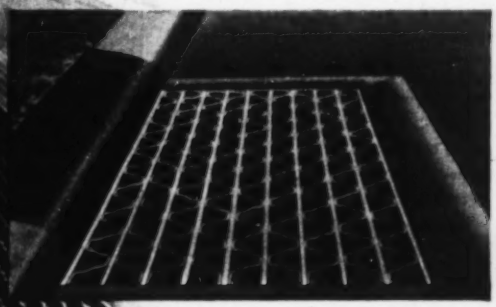
IRVING DECKING is 80% open, self-cleaning and self-draining, non-floating, not affected by wind pressure, lightweight, strong, safe, practically self-maintaining.

ONLY IRVING OFFERS you over 50 years of experience in quality production and sound application of open mesh metal flooring. Take advantage of it! Write for new engineering data catalog covering all fields of application.

"A FITTING GRATING FOR EVERY PURPOSE"

Manufacturers of Riveted, Pressure-Locked, and Welded Gratings.

Sidewalk Grating for Bridges, Gutter Catch Basin Covers, Armourings for Heavy Duty Floors, Trucking Aisles, Loading Platforms, Boiler Room and Plant Flooring, Catwalks, Runways, Stair Treads, Sidewalk Grating, Tree Guards, Balcony Flooring, Airfield Landing Mats.



IRVING "DRYWAY" DRAINGRATES are simple to install, easy and inexpensive to maintain. These safe, clean and strong drain covers are available in Rectangular Mesh and Riveted Types.

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TREATMENTS: INDIVIDUAL OR COMBINED			
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Annealed	X	X	X
Spheroidize Annealed	X	X	X
Normalized	X	X	X
Stress Relieved	X		
CONDITIONS: INDIVIDUAL OR COMBINED			
Hot Rolled	X	X	X
Straight Lengths	X	X	X
Coiled	X	X	X
Flattened or Leveled	X	X	X
Gas or Special Cutting	X		
Pickled	X	X	X
Sand Blasted	X	X	X
Oiled	X	X	X
Formed, Machined or Other Special Conditions	X	X	X
SPECIFICATIONS REQUIREMENTS: INDIVIDUAL OR COMBINED			
Grain Size	X	X	X
Macro-Etch	X	X	X
Micro-Cleanliness	X	X	X
Restricted Chemical Analysis	X	X	X
Special Mechanical Tests	X	X	X
Impacts	X	X	X
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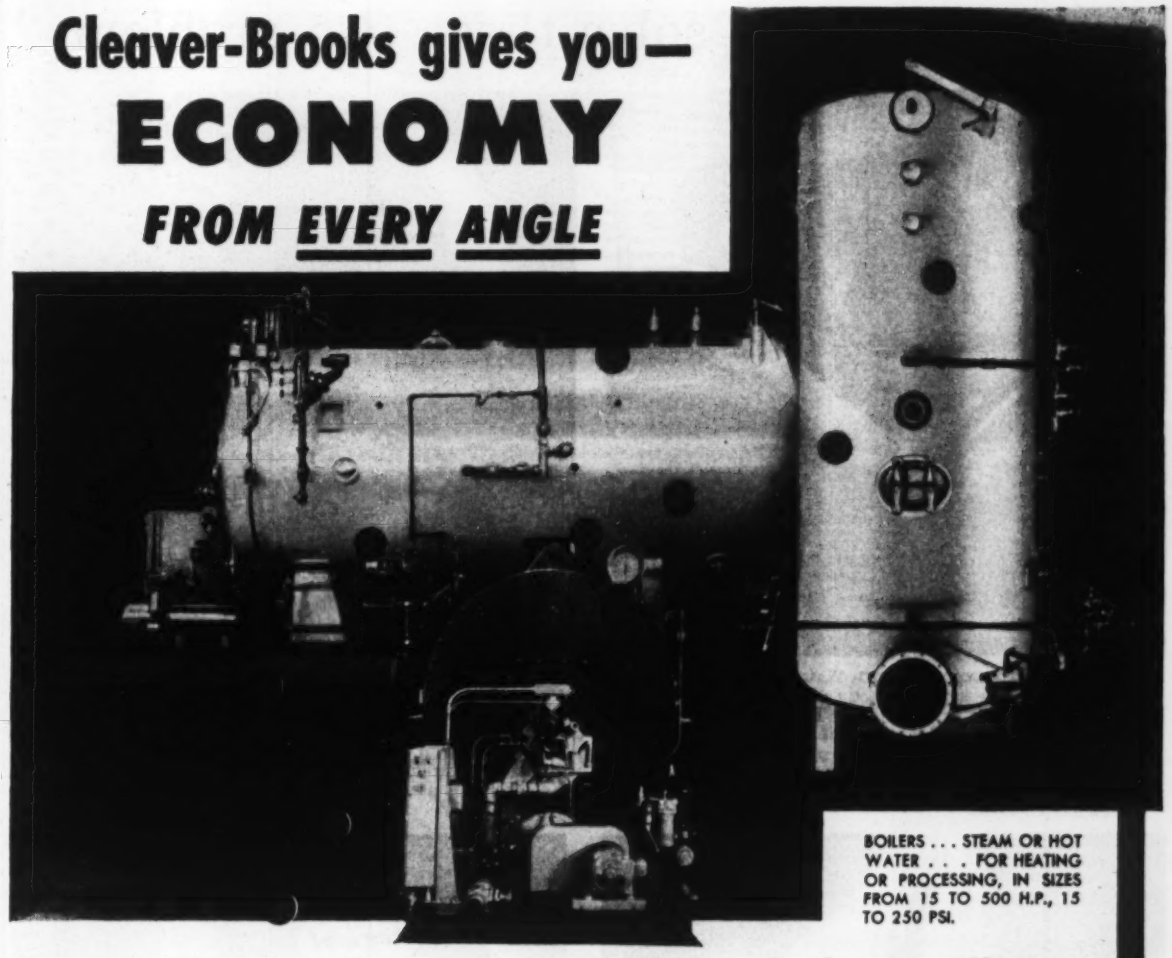

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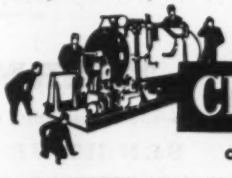

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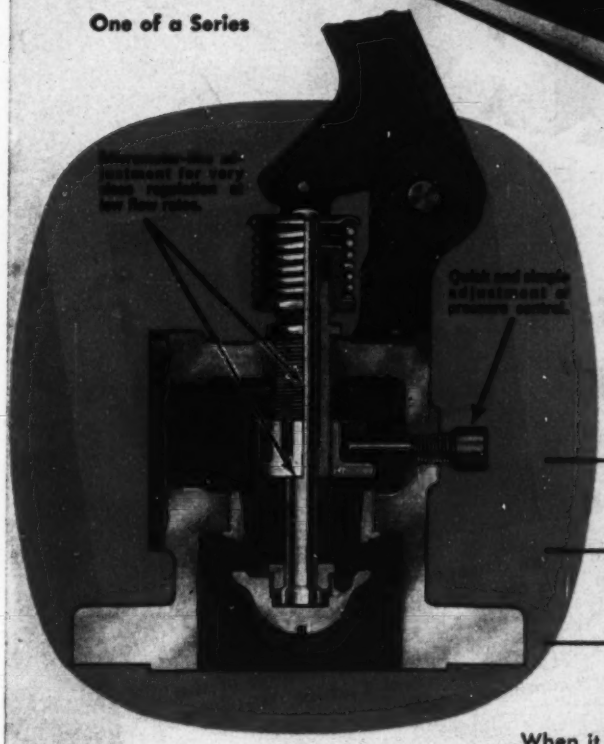

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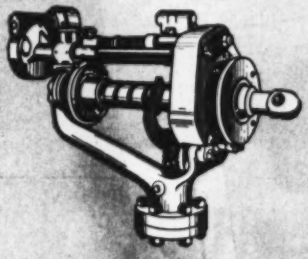
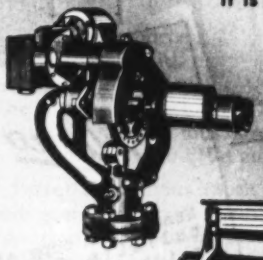


Diamond Model IR
Short Retracting Blower



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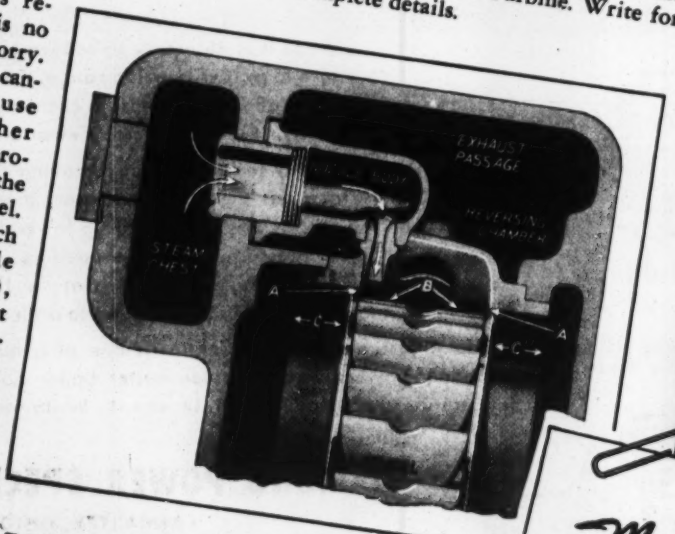

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Memo

Send for a copy of bulletin S-116 which describes the many advantages of the Terry Solid-wheel Turbine.

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Diagram showing how "Alert" Tank Ball and Guide is installed in toilet tank. Installation takes only ten minutes. Plastic cylinder guides ball down onto seat accurately. Made by Ardmore Products Co., Conshohocken, Pa.

Probably every household is bothered at times by a "runny" toilet tank.

Once let the conventional arrangement of wires, guides and ball-spindle get just a trifle out of adjustment, and the water gurgles and splashes until someone jiggles the handle. Or else takes off the tank cover and re-seats the ball by hand.

A designer of surgical appliances had his rest disturbed by a noisy toilet tank just once too often. So he tore out the tangly wires, did away with the shifty wire guides, and substituted a hollow plastic tube and a round rubber ball suspended on a non-kinking chain.

But he didn't stop there. He realized there were several spots where even this simple device *could* fail or get out of kilter. One was the hook, chain and insert in the ball to which the chain is fastened. He foresaw how corrosive attack or wear might cause them to weaken and break.

The other two spots were the two riveted clamps with their spring grips that hold the plastic tube firmly in alignment. If they weakened or lost their spring properties, the tube could become dislodged.

To guard against failure in those three spots, he specified strong, corrosion-resistant Monel.

The device worked so beautifully he decided to make it commercially. The result is the famous "Alert" Tank Ball and Guide described in newspapers and popular magazines.

Perhaps the experience of this designer reminds you of some application in which metal failure has been bothering you. If so, Monel or one of the other Inco Nickel Alloys may prove a ready solution to your problem.

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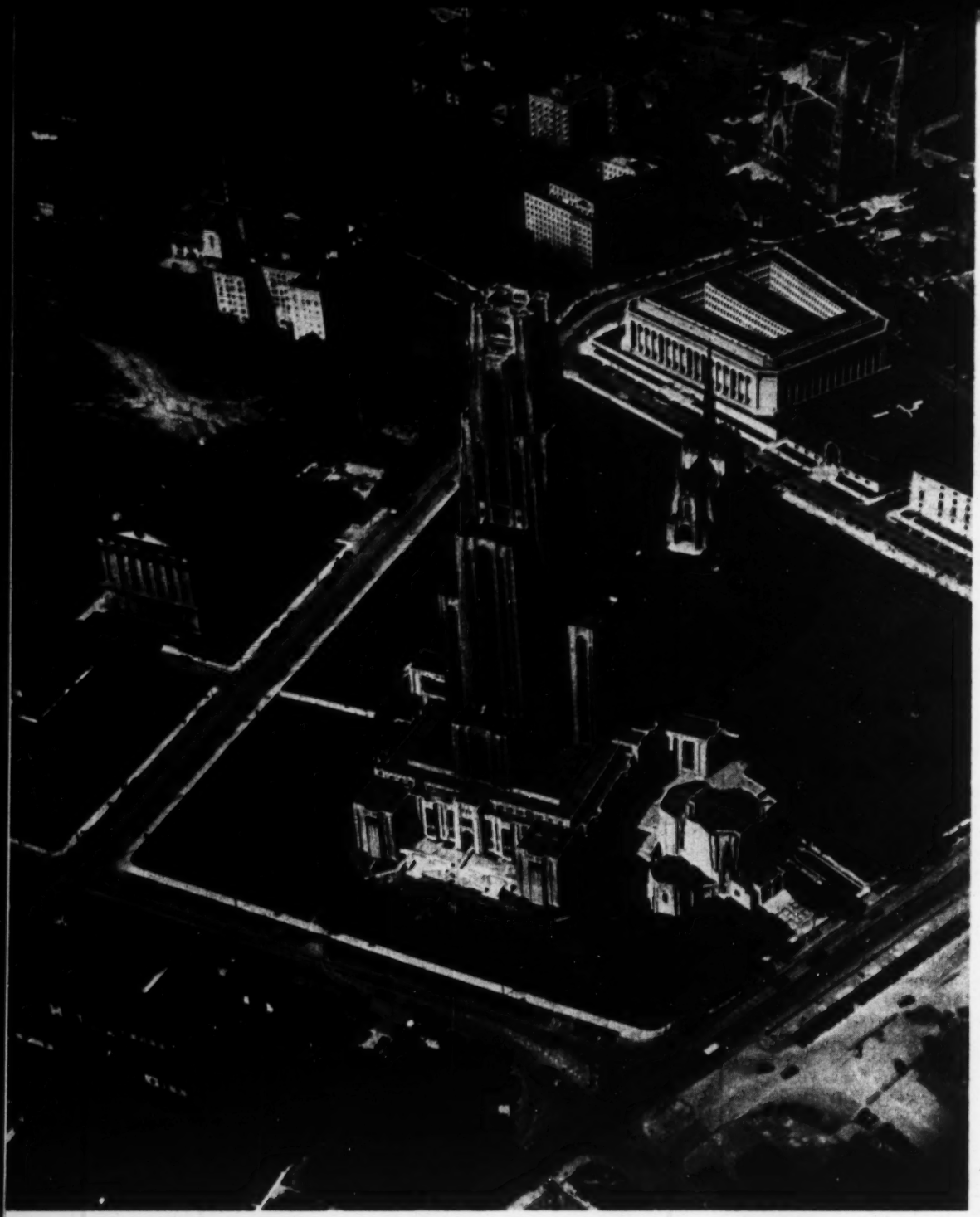

Cathedral of Learning, Pittsburgh, Pa. . .

. . . is shown here in center of picture. The Mellon Institute is in right background and the Stephen Foster Memorial in right foreground. Pittsburgh was scene of 1954 ASME Semi-Annual Meeting. For details, see ASME News.

Editorial

MECHANICAL ENGINEERING

August, 1954, Vol. 76, No. 8 . George A. Stetson, *Editor*

The Great Emancipation

RECENT discovery of a solar ship in Egypt sharpens the contrasts between the civilization of the Nile Valley of antiquity and that of the western world of today. Among those contrasts none is more significant than the changed condition of man himself—the emancipation of his spirit, of his social and political institutions, of the economy in which he lives, and of his material well-being from ignorance, fear, and superstition, from certain hazards and restrictions of his environment, from bondage and slavery, and from tyranny and despotism. We of the western world of today hail this great emancipation as evidence of human progress and advancement. And those of us who find satisfaction and future promise in free private enterprise and our current industrial society, pay tribute to the contributions made by engineering and the mechanic arts to the evolutionary developments toward that emancipation that have taken place during the long centuries in which the sands of Egypt have drifted over the rock chambers so recently uncovered.

The Egyptian funerary ship with its tomb and its cargo represents to us a system of producing goods that is the antithesis of the mass-production methods of today and the push-button factory of tomorrow. To us who live in the age of power and machinery, the accomplishments of the engineers and craftsmen of antiquity are well nigh incredible, as incredible, perhaps, as our own accomplishments would appear to them. In this dynamic world, change comes not only to environment and institutions, but also to the human spirit and to the concepts, beliefs, and thought processes of men.

The mind of man has changed during those long centuries of evolutionary development, and truth, as men discern it and interpret it, changes with it. We may repeat the words so dear to earlier civilizations—the good, the true, the beautiful—but the meanings of those words have changed. The freedom of the "freedom-loving Greeks" is a social concept quite different from the freedom enjoyed by freedom-loving Americans. Much has been learned during those intervening centuries, but much more remains to be learned before the great emancipation of mankind is complete.

The social systems of ancient civilizations were slave-supported. The many labored, suffered, and died that a few might have abundance, exercise power, and prepare themselves for eternity. But it was in the minds and labors of slaves that the seeds of man's emancipation germinated.

Compared with life today, the economy of Egypt was static. The rhythmic flooding of the life-giving Nile annually restored the fertility of the soil but did little to increase human productivity. But in the last two centuries, Watt's steam engine, machinery, and machine tools have increased tremendously the productivity of every craftsman and the quality of his product. When labor is transferred to machines, the laborer himself is set free. He becomes the master, rather than the slave.

As one ponders the contrast of the lot of the average citizen of the western world today with that of the artisan slave of ancient Egypt one may wonder if the shifting of the burdens of toil from men to machines may one day increase the productivity of labor to the point where there will no longer be enough work to support an increasing population. Such a speculation is sometimes raised in discussions of the automatic factory where the reduction in work forces necessary to carry on the production of goods and materials causes particular apprehension.

Are we carrying the emancipation too far? Assuredly not. Even in the western world it is not complete. A century ago Samuel Colt hired an engineer, Elisha K. Root, to manufacture his patent pistol. Root worked out a system of manufacture involving jigs, fixtures, tools, and gages for mass production along lines laid down by Whitney and others. The cost of the special tool and gage equipment exceeded that of the machines employed. Many persons considered Root to be crazy, but his system was mechanically and financially successful. As J. W. Roe has stated, "Colt's revolver has practically disappeared, but the way Root made it has spread everywhere."

So it was a hundred years ago; so it will be a hundred years hence. Because of mass-production methods, physical labor has been reduced, wages increased, hours of labor shortened, and the abundant products of labor are consumed by the men who produced them. The great emancipation goes on, spurred by engineering and the mechanic arts, by science, by social, economic, and political evolution, by the enlightenment and flowering of the human spirit, by religion and philosophy, by the arts and cultures of emancipated peoples, by education, by research, and the quest for truth.

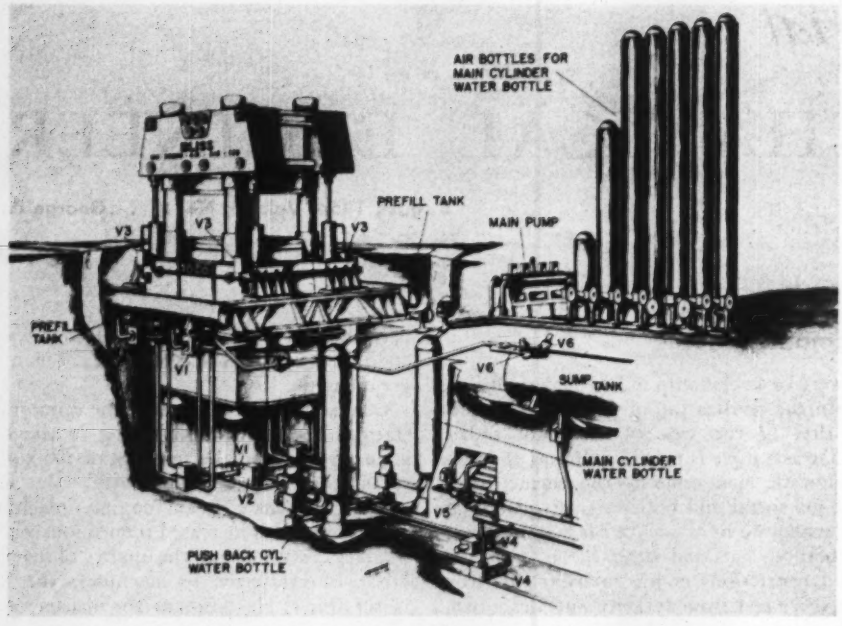

Fig. 1 Perspective sketch of 25,000-ton forging press and elements of its system. Valve designations refer to Fig. 2.

Controls and Safety Devices of Heavy Presses . . .

. . . with particular reference to the Air Force 25,000-ton-capacity press

By E. V. Crane and W. R. Jackson

E. W. Bliss Company, Canton, Ohio

THE Air Force heavy-forging-press program caught the public imagination by reason of the gigantic size of its units. It focuses attention upon the great forces exerted in the metalworking presses which are the backbone of mass-production processes for both war and peace. Despite the cutbacks in the program, it is still one of the great forward strides in providing potent means of accomplishment which require long lead time to prepare.

Interests of the Fluid Power Systems Division of ASME carry beyond the colossal presses to the dozens of pumps, large and small, hundreds of valves of many sorts, and miles of piping and wiring required to operate such units. The principles of the control systems chosen and the safety devices incorporated in them are described briefly, with particular reference to the 25,000-ton-capacity press.

Contributed by the Hydraulic Division and presented at a joint session of the Hydraulic and Aviation Divisions at the Annual Meeting, New York, N. Y., Nov. 29–Dec. 4, 1953, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Condensed from Paper No. 53—A-223.

Major Elements of Heavy-Press Plant

The original arrangement of the Air Force light-metals forging plant for Newark, Ohio, included in one bay an 8000-ton, a 35,000-ton, a 25,000-ton, and a 5000-ton press. Adjacent to this group of presses were a 3000-ton and a 1500-ton press. Foundations, pits, and passageways below the floor, as indicated in the perspective sketch of the 25,000-ton press, Fig. 1, provided space for tanks, water bottles, operating valves, and connecting pipe lines. This general arrangement was worked out to keep the water bottles, which are the immediate sources of hydraulic power, as close to the rams in the press bases as practical.

The pump room is located at a 15-ft lower level and in a bay adjacent to the main press room. It contains space for the six 500-gpm pumps with 1500-hp motors, the air compressors, certain of the auxiliary pumps, and

the strainers. Almost a third of the room is devoted to the electrical center. Four banks of control panels are provided to contain standardized starting units for motors and relay cabinets for controls, system interlocks, indicating lights, etc. Approximately 10,000 kva of electrical power is brought in at 4160 volts. The six main-pump motors are connected directly on 4160-volt lines. Transformers reduce from this voltage to 440 volts for compressor motors, sump and auxiliary-pump motors, and valve-control motors. Some lines also are brought down to 110 volts for all of the push buttons, relays, and solenoids of the control systems. Some rectified 24-volt direct current is used for control of the fast-acting valves protecting the water bottles.

A schematic diagram of the composite system is shown in Fig. 2.

The high-pressure system utilizes up to 5300 psi for recharging of both water and air bottles at each of the presses and this determines the capacity of the main pumps and compressors.

The low-pressure water system used for prefilling the main cylinders as each press approaches the work is designed for a maximum of about 200 psi although this may be reduced in operation to less than 100 psi as required. This system comprises two prefill tanks on each of the large presses and one on each of the small presses. Pressure-regulator valves and safety valves control the air pressure in these tanks, and level controls of the mercury-manometer type regulate the release of surplus water at the end of each return stroke to the main sump. Note that the amount of low-pressure water required for prefilling the main cylinders of the presses is always less than the amount to be pushed back into the prefill tanks during the return stroke by the volume of the high-pressure water added during pressing.

Water from the high-pressure system is used for pressing, pushing back to top stroke, and ejector cylinder.

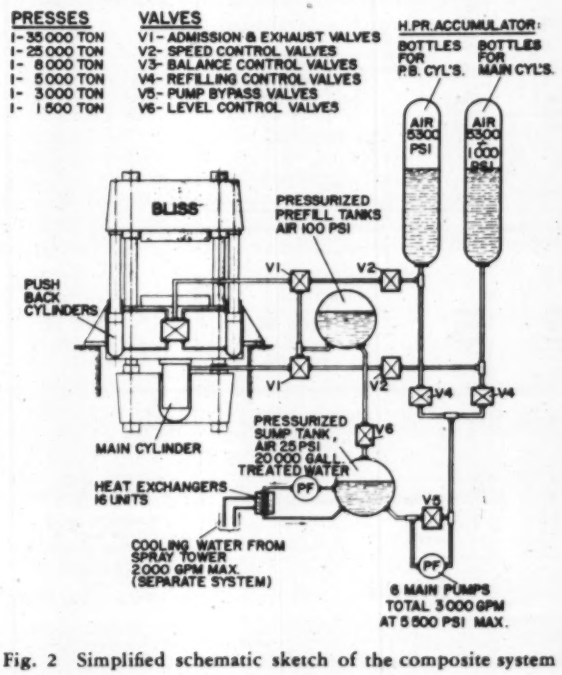

Fig. 2 Simplified schematic sketch of the composite system

It is also used for pilot actuation of the large high-pressure admission valve and the prefill valves.

Four 2500-psi hydraulic systems are included in the over-all plan. Two of these, with reversing variable-delivery pumps, hydraulic motors, and gear reducers were selected to give precise and smooth control for traversing the tables of the two large presses. With a potential mass of perhaps 350 tons to be accelerated quickly or moved precisely for positioning or for bending operations such a unit is particularly desirable. Oil is used in these systems for protection of pump and motors. No accumulators are required and the unit is below the floor.

The other two 2500-psi systems duplicate each other for assurance and are used to pilot the operation of the two-way check valves between the main high-pressure-pump manifold and the water bottles. They also actuate the locking of press tables and the elevating of floor sections to fill the gap after the press tables have been moved back into position. On the smaller presses they furnish the hydraulic power for the cylinder which moves the press tables in and out. These two units use Aldrich packed-piston pumps with small accumulators to equalize the demand and assure the supply for piloting.

Secondary Hydraulic and Pneumatic Systems

A number of secondary hydraulic and pneumatic systems may be distinguished from the major systems just discussed. These are the systems for air-supply cooling, filling, transferring, and scavenging.

Remotely controlled valves operated from the central selector station permit isolating individual bottles for maintenance, or for the regrouping of air bottles connected with the main-cylinder water bottles of the two large presses. The push-back bottles normally would be kept up to the full 5300 psi, with water at the desired level. The main-cylinder bottle groups, however, may be maintained at a lower pressure if so desired to suit smaller dies and a lower operating range. Pressure regulators with remote control are furnished for this purpose.

Accumulator systems develop considerable pressure-drop heat at their throttling or speed-control valves. Most of the water thus heated goes to the main cylinders and thence to the prefill tanks. For this reason the heat exchangers were arranged to operate on the prefill tanks of the two large presses. The treated water drawn from each of these tanks is pumped through a heat exchanger below it and returned to the tank. Untreated cooling water is separately circulated.

The Multiple-Pumping Problem

The manifolding of the output of six main pumps and by-passing them, as required to meet demands of the 12 level-control units on the water bottles, represented a substantial problem in view of widely different press needs and absolutely indeterminate timing of demand. The completion of the pressing portion of any press stroke may be used to signal need for pumping capacity. The level-control contacts on the bottles may be used to signal satisfaction of the demand.

This multiple-pumping control is currently planned around a rotary drum switch or its equivalent, to sequence the six pump by-pass valves in and out successively from no delivery to full output and back. The positioning of the drum switch to suit demand then re-

quires an adding and subtracting device to rotate it more or less as demand rises and falls.

By adjusting positions of drum cams it is possible to assure rapid filling by having all six pumps delivering to the manifold at, say, 60 or 70 per cent of full demand.

At the low end of the scale the "full" indicator positions of the level-control switches must be interlocked to permit one pump to come on to meet slippage losses and to insure a zero position reset of the drum switch, when all bottles are full. It is planned tentatively to have No. 1 pump on at the 1st notch (which would take care of the smallest press), No. 2 pump coming on at the 4th, No. 3 at the 8th, No. 4 at the 12th, No. 5 at the 16th, and No. 6 at the 20th. This would put all pumps on with only two thirds of the press capacity in simultaneous operation. It would favor fast operation with considerable working strokes. On the other hand, if some presses are not operating or the working strokes are relatively short, the proportioning may be readjusted or some pumps may be switched out of operation.

Large-Press Control System

The control system for the 25,000-ton press, Fig. 3, differs in several respects from that used on the smaller presses. Particularly, in view of large investment and multiple valving, electrical sequencing of control is used throughout, as on oil-hydraulic self-contained presses. This assures positive relation of successive steps and eliminates faulty judgment. A servo control of the main admission valve permits sequenced operation without sacrificing the optional throttling of speed during pressing by the operator. In Fig. 1 the prefill tanks are shown each side of the press with the prefill and exhaust valves V1 immediately below them, indicating the short lines and balanced piping arrangement. Simultaneous pilot operation of the four prefill valves is obtained from a main cylinder and four identical master pistons. Balanced high-pressure interconnection of the prefills to the central admission valve (shown at the bottom of the pit, V1, in Fig. 1) also prevents unbalanced pressures.

A main control valve pilots the operation of the main admission valve and the four prefill and exhaust valves. The latter valves include a small-area seat which opens first for decompression after pressing. The main valve is servo-operated from the operator's pulpit. The lever which he has permits manual throttling during pressing if desired, but all operations are electrically sequenced and interlocked.

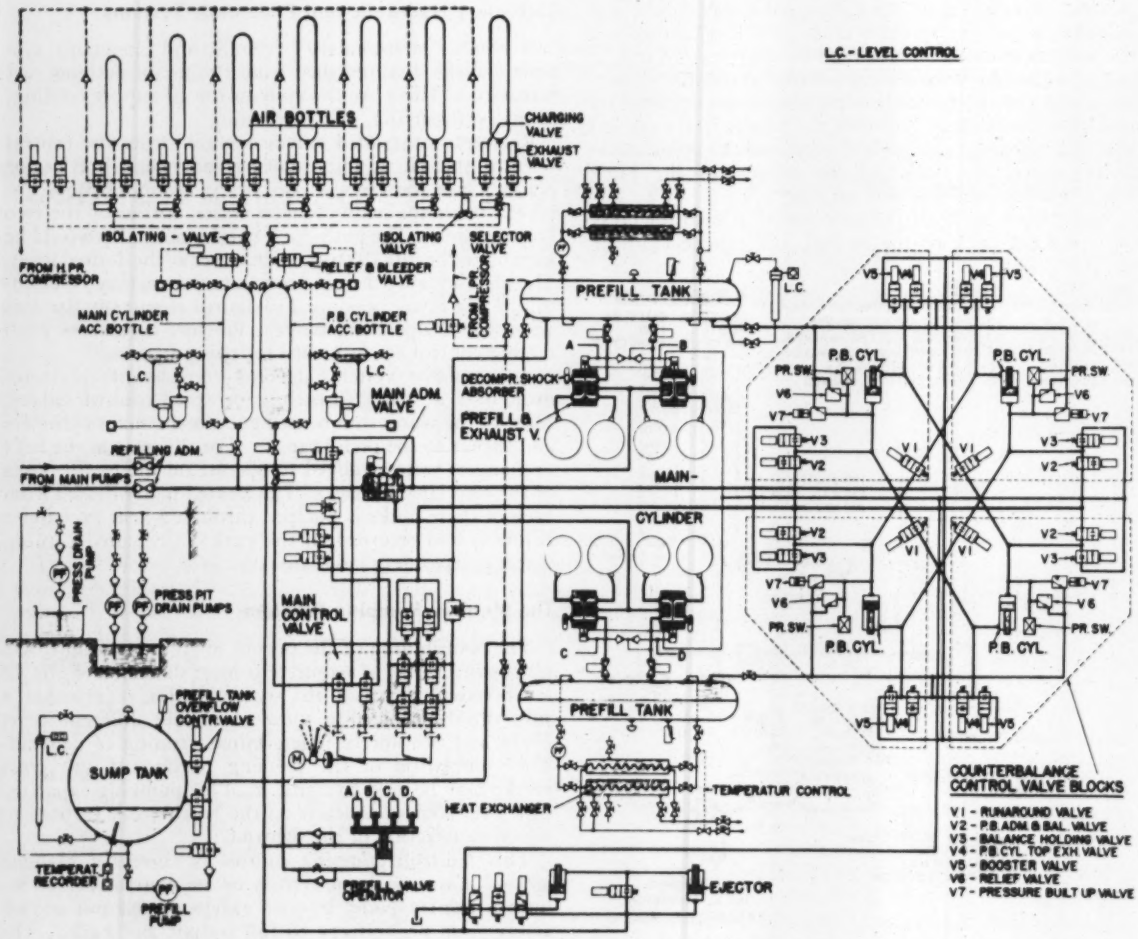

Fig. 3 Hydraulic and air circuits for 25,000-ton forging press and elements in its pit, using JIC symbols

The pressing speed control is built into the block with the main admission valve. It is essentially a balanced plunger in a sleeve with small drillings for the high-pressure drops, increasing to large drillings at the low-pressure drop. It is servo-actuated from a tachometer-type pickup which indicates and adjusts pressing speed and is electrically interlocked with the press cycle.

During the rapid advance of the press, both the run-around and sump-tank valves are opened. Thus liquid from the lower or push-back portion of the push-back cylinders goes to fill the smaller upper area and the balance of the liquid from the underside goes to the sump tank.

Pressing Operations

During pressing, where counterbalancing is desired to offset possible unbalanced loading, the run-around valves are left open and the outflow is restricted to build up a counterbalancing resistance on whatever corner or corners may be leading. Each pressure-build-up valve is air-piloted in a close-coupled arrangement from a sensitive preloaded cable system for detection of unbalance. The servo control works on a slight tilt and is such that the amount of pressure build-up continues until balance is satisfied. Areas are chosen, however, so that approximately 5000 psi satisfies the maximum specified unbalance of full tonnage 2 ft off center on the long axis of the bed or 1 ft off center on the short axis, or in between on the diamond pattern limited by these points. Relief valves and pressure switches to stop the press, if 5000 psi is exceeded, protect it against greater amounts of unbalanced loading. The run-around valves are cross-connected between the lower push-back area on one corner and the upper or booster area of the diagonally opposite corner. Thus when a counterbalancing pressure is built up on any diagonal, it is exerted as a couple, up on one corner and down on the diagonally opposite corner so that pressing capacity is not sacrificed to the counterbalancing effort.

Alternatively, where symmetrical or balanced jobs are being run, electrical selectors make it possible to eliminate the counterbalancing system and use the boosters to obtain an additional pressing capacity of almost 5000 tons over the normal rating (of the main cylinders) of the press. This is done by leaving the lower end of the push-back cylinders open to tank and applying high pressure to the upper or booster areas through the main admission valve and four small valves in the corner blocks. Accidental unbalance under such conditions is electrically detectable through the cable system, to stop the press.

At bottom stroke, reversal may be initiated by pressure switch, by a position-limit switch, or by the manual lever of the operator's drum switch. The first step is decompression through small seat areas of the four prefill and exhaust valves. For stripping and the quick-return stroke, the run-around valves are closed, the booster areas opened to by-pass to the sump tank, and high-pressure water is admitted to the push-back areas through a speed-limiting manually set throttle valve. The upstroke position of the press may be controlled through the closing of the push-back admission valves either by the operator's manual lever or by an adjustable top-stroke limit switch.

When cogging or repeated short strokes for flat-die forging are required, a selector switch at the operator's pulpit changes the relay grouping so that push-back pressure is maintained constantly, and the opening of the prefill and exhaust valves is restricted by limit-switch control on the master cylinder. The constant push-back pressure saves some time on the pressure build-up because it maintains a partial preload on the main cylinders.

Ejector positions in the center of the press bed and in the center of the out position of the die slide are interlocked with the die-slide position so that only the correct one may be operated. An adjustable limit switch may be set to limit the upstroke position of the ejector to suit the part being produced. Fixed limit switches cut off pressure in advance of contacting the fixed stops at top and bottom in the press structure.

Individual controls are provided at the operator's pulpit for the ejector, the die slide, the die-slide locks, and the elevating and locking of the section of floor which fills in flush after the die slide and cover have moved back into the press. Electrical interlocks are required to insure that each motion is completed before the next is undertaken.

Safety Features

Safety features provided in equipment of this sort have been more or less apparent in the foregoing discussion of controls. A variety of electrical interlocks are provided to insure that services are functioning properly before motions are started and to give proper sequencing to assure completion of one motion before the starting of another which might interfere with it. With a variety of services involved it is the object to provide that parts shall fail safe if failure should occur. It also is necessary to plan for the saving of small increments of time and energy in the operation of the system. In the alternative manual control of such a series of operations from his remote pulpit a conscientious operator is subject to fatigue in his efforts to get the most out of his machine and yet avoid shocks or interferences. His caution or his fatigue are likely to result in a substantial cumulative time loss made up of many small increments. With the high time charges on large equipment such losses are particularly to be avoided. Automatic sequencing uniformity is also believed to contribute to uniformity of forgings and consequent reduction of rejects.

Prevention of overloads by the hydraulic limitations of power sources, pressure switches, and relief or safety valves is an inherent precaution of hydraulic presses. Even so, hydraulic presses, particularly of open-rod frame construction, have been damaged by off-center or unbalanced loading. In addition to the protective counterbalancing system which has been described, mechanical precautions also are taken. Sectional frame members are aligned with double-tapered keys and held together with substantial prestressed transverse tie rods.

The main tie rods, 72 ft in length, are hollow-bored forgings which are prestressed in both the upper and lower frame members for sway stability and for the reduction of load fluctuation in critical areas. The rods, which are loaded in tension, and the nuts loaded in compression, are designed for improved distribution of stresses as the load builds up. The roots of the grooves are cold-rolled to improve their endurance properties by building up an internal prestress in the metal.

Mechanical-Engineering Progress in the Petroleum Industry[1]

- *Production*
- *Transportation*
- *Refining*

Petroleum-Industry High Lights[2]

New drilling methods, the percussion-bit, and jet-bit drilling have all contributed to new record depths. The deepest well is now down to 21,482 ft—nearly 3000 ft deeper than the 1952 record. Sound waves are used to motivate a new deep-well pump that has been tested successfully by Standard Oil Company of California. Atlantic Refining Company has announced the success of a high-pressure secondary recovery technique that is one of the most significant developments in years. New progress in mechanical engineering has preceded each of these developments.

In the transportation field, we have seen the completion of the Lakehead Pipeline Company's 30-in. crude line from Superior, Wis., to Sarnia, Ontario. The Mackinac Straits crossing on this line sets a new depth record for underwater crossings. Mechanical-engineering progress has led to reduced vapor loss from tankage, new methods of cathodic protection, and refinements in communication and control systems. New improvements in the operation of automatic stations make them more satisfactory than ever before.

The refinery processes most in the news include continuous coking, catalytic reforming, and catalytic desulphurization of feed stocks. The fluid-coking process is outstanding in its field. This process gives the refinery a tool that has been needed to deal with a changing picture in the residual-fuel-oil market.

Catalytic reforming units lead the field in new facilities to provide higher-octane gasolines. The catalytic-desulphurization processes have been developed as necessary, to reduce the sulphur content of feedstocks to catalytic reforming units. One of the desulphurization processes shows promise for use on crude stocks as well as naphtha charge cuts. This development could mean a lot in the handling of sour crudes.

Petroleum Production[3]

PETROLEUM-PRODUCTION equipment trends are, generally, toward reduction of equipment costs, reduction of maintenance, and keeping field force necessary to operate and maintain the equipment at a minimum. The developments are so numerous that it would be impossible to list them without going into great detail. For example, a minor yet important item is that of improvements in counterbalancing on pumping units (1).[4] This involves the simplifying of the mechanics of adjusting counterbalance to obtain proper torque balancing. While this is a minor improvement and utilizes the same basic type of equipment, it is important from the overall standpoint of maintenance and of keeping equipment requirements to a minimum. Once equipment is installed, proper counterbalance is extremely important to keep surface-equipment maintenance expenses under control.

Off-Shore Drilling Barges

The development of off-shore areas has resulted in a wide range of specialized equipment and partly ties in with the development of equipment for exploitation of inland water areas, particularly those along the Gulf Coast. The development of equipment primarily for the Louisiana areas has resulted in design of special-duty barges. These include a four-deck barge 237 ft long × 54 ft wide, carrying a rig which drilled a 20,527-ft well in Montana (2).

Another large rig is the $\$1\frac{1}{2}$ million barge unit capa-

[1] Based on three papers contributed by the Petroleum Division and presented at the International Meeting, Mexico City, Mex., March 10–12, 1954, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

[2] An introduction by O. L. Lewis, C. F. Braun & Company, Alhambra, Calif. Mem. ASME.

[3] By Emory N. Kemler, Institute of Technology, University of Minnesota, Minneapolis, Minn. Fellow ASME. (Condensed from ASME Paper No. 53—Mex-17.)

[4] Numbers in parentheses refer to the Bibliography at the end of this section.

ble of drilling to 20,000 ft. It is 190 ft long × 54 ft wide × 12 ft deep. This unit carries a 156-ft derrick, and five 8-cyl supercharged diesel engines with a total of 3350 hp (3). For inland waterways, a submergible barge service unit has been developed for servicing wells up to 10,000 ft deep (4). It can navigate in 2 ft of water and can submerge 8 ft. It is 88 ft long × 30 ft wide × 10 ft deep. It carries a 60-ton mast with a 65-ft working space below the traveling blocks.

The development of barges for drilling and servicing of wells has resulted in a portable tank barge (5). Such a unit is both portable and less susceptible to storm damage than conventional units. One unit with a deck space of 60 ft × 48 ft with a 5-ft depth carries a 48-ft-sq tank with four compartments. Each compartment is capable of holding 1250 bbl. The tank proper is supported above the barge on nine steel columns 20 in. in diam. The tank is elevated 21 ft above the deck of the barge. The top is flat and carries oil and gas separators, manifolds, and other equipment. The barge may be refloated.

Since these drilling barges are used for living as well as working quarters, every attention is given to methods of noise and vibration reduction. Considerable progress is being made through the use of rubber isolation and attention to structural design (6).

Drilling Techniques

One development which has moved from the experimental to the standard-practice stage is that of drilling with gas (7). Some work also has been done with drilling with air in some areas (8). One gas system is described as using two to four 6000-cfm compressors with pressure of 200 psi. The best drilling rate obtained was 550 ft in 31 hr in the west Texas area. Another Texas area recorded drilling down to 9000 ft, carried out by using gas, at phenomenally high drilling rates in areas of extremely hard formations (9).

Improvements in techniques for moving rigs, particularly in areas such as west Texas, have also been made. One reported development describes the moving of rigs of 15,000 ft capacity on which drilling can be started 8 hr after the move starts (10). Another example has been given of a rig where drilling starts five hours after moving begins. This rig was transported $^{1}/_{8}$ mile, the rig set up, and surface casing set in 12 hr (11).

Many developments which are going on relative to offshore platforms make it difficult at this time to predict the ultimate solution of this difficult problem (13, 14). During the past few years there has been a major change from the large platform which was introduced earlier to much smaller platforms and use of a service vessel. Development in connection with concrete structures which can be floated to site and submerged would appear to offer many possibilities for standard structures which can be built and operated at low cost. A more recent development involves the design of a derrick which can be used for drilling six wells without moving the derrick itself. The scheme utilizes directional drilling.

Automatic Controls

Considerable attention has been given the problem of applying automatic controls to simplifying and carrying out many oil-field operations (15). These have been applied extensively during the past year to producing operations where production of both pumping and flow rates are automatically controlled (16). Tank batteries handling four wells have been equipped with automatic controls to handle production and transfer the oil to batteries from which lease production is sold (17). Estimates on cost of converting from standard to automatic batteries indicate that the cost would be about $2500. Estimates indicate that pumper productivity has been doubled in many cases through this means (18). The use of automatic controls in connection with drilling rigs has likewise received much attention (19). The heavy equipment and longer strings of drill pipe on deep wells make utilization of automatic equipment more attractive. The push-button rig increases trip speed, reduces fatigue hazard, and generally improves efficiency.

Oil-Recovery Methods

The recent advances in the permanent-type well-completion technique offers opportunity for radical developments in well completion and production methods (20, 21). The methods permit moving the drilling rig off location as much as two days earlier, giving better completions and permitting selective perforation. This is of importance in thin sand sections.

New developments in connection with oil-recovery methods include the use of injection of atmospheric nitrogen in connection with pressure maintenance (22). Where natural gas is not available, atmospheric nitrogen has worked out satisfactorily. The gas supply comes from the plant boilers and is 90 per cent nitrogen and 10 per cent CO_2. High-pressure gas injections utilizing pressures up to 4000 psi have developed satisfactorily (23, 24). A displacement efficiency of 90 per cent against 50 per cent for water injection is indicated. Tests utilizing in situ combustion look promising (25). From between 2 and 15 per cent of crude is burned in place. Recoveries from 60 and 90 per cent of the oil in place prior to combustion appear possible.

The increased use of multiple completions has required the use of multiple production strings (26, 27). In one case, three horizons have been produced through three strings of $1^{1}/_{2}$-in. tubing. Pumping of dual completions has been satisfactorily developed (28). By use of a 30-ft polish rod a change in horizons can be made by raising or lowering rods to permit pumping from the upper to lower zone.

One workover method which was developed into standard practice utilizes hydraulic fracturing (29, 30, 31, 32). Hydraulic fracturing can be used to increase the drainage area, break through permeability blocks, and break through to permeable oil-saturated zone. The use of plugging material in connection with hydraulic fracturing permits multiple fracturing to take place. In a report on 9360 wells to which hydraulic fracturing was applied, 75 per cent are reported as responding to treatment with an average increased production of 175 per cent.

Electronic Computers

Considerable attention has been given during the past year to the application of electronic computing devices to solution of production, drilling, and engineering problems (33, 34). These methods are particularly

helpful in routine procedures which require large numbers of calculations and in the study of certain complicated problems requiring solution of differential equations. The oil industry has developed many special-purpose computers. The utilization of standard units for many problems offers many opportunities for development.

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Petroleum Transportation[5]

THE rapid absorption of new developments by the pipe-line industry is evidenced in the continual revamping of existing installations and the new concept they have given to pipe-line design.

Trends in Line and Station Design

Pipe

In the past three years the U. S. pipe-line industry has used nearly 2,000,000 tons of steel in building approximately 23,000 miles of new pipe lines. The largest oil line built to date is 31 in. in diam; however, 30 to 36-in-diam lines are common in the gas industry. The economic justification of the use of larger diameters is based in part on the availability of higher-yield-strength thin-walled pipe.

[5] By A. H. Newberg, Mem. ASME, Chief Engineer, and E. C. Schuster, Assoc. Mem. ASME, Engineer, Service Pipe Line Company, Tulsa, Okla. (Condensed from ASME Paper No. 54—Mex-21.)

Manifold and Fittings

The trend in manifold design is simplification, with all piping and fittings installed above ground. The use of forged-steel welding-end fittings and valves is becoming more prominent, and it is rapidly replacing the heavy bolted-flanged installations used for many years. Most of the larger valves are of the double-disk through-conduit type. Soft synthetic-rubber seats are eliminating many of the wear and leakage problems encountered with metal-to-metal contact surfaces.

In valve design the application of "O" rings and snap rings, particularly in the bonnets, and a more careful analysis of metal location have resulted in a major streamlining of designs and a consequent reduction in cost. Test results of O-ring seal-flange joints (both raised and flat-faced) have indicated the economic advantage and superior operating features of this assembly. Replacing the standard flat gasket with an O-ring seal permits the use of lighter-weight flanges and greatly reduced bolt loads. For example, an ASA 300 flange will withstand cold-working pressures comparable to

an ASA 600 flange in diameters to 16 in. without deviating from basic code requirements. Here is an O-ring application that will surely bear study by the ASA, other material testing organizations, and flange manufacturers.

New packing materials, such as Teflon, with a high resistance to corrosion and superior antifriction qualities are replacing many of the older types.

Station

The corrugated-iron and other prefabricated buildings used in the past are disappearing rapidly. In their place has risen a modernistic compact masonry unit. Even the building's function has changed. Formerly it was used to house machinery and equipment; now it is primarily a control center and office, with pumping equipment weather-protected for outdoor operation.

Prime Mover and Pumps

Perhaps the greatest change in pipe-line design has been in the prime movers and pumps. Some pipe lines have gone completely to electric motors and centrifugal pumps. Others have used various types of reciprocating engines such as full diesel, dual-fuel, and gas, and reciprocating or centrifugal pumps. All of them have kept their eyes on the latest gas-turbine and free-piston-engine developments. Since economics dictates that there must be a balance between initial investment and operating expense, no one combination of prime mover and pump is applicable to all installations.

Many innovations have been made on the older diesel engines to increase their economy, such as supercharging, low-pressure starting systems, replacing air injection with solid injection, dual-fuel conversion, vapor-phase cooling, and ambient-air temperature control.

The development in recent years of dual-fuel, trifuel, and the high-compression spark-ignited engines was a great stride forward by the engine industry.

The gas turbine has come into its own as a prime mover and has had numerous applications in the gas pipe-line industry. The extent to which the gas turbine will replace other types of prime movers will depend on economics as dictated by thermal efficiency and the availability of sizes and types to fit oil-pipe-line demands. The rapid development of usable atomic power may provide the answers for the future.

The large slow-speed plunger pumps have been replaced by the multicylinder high-speed reciprocating pumps and the centrifugal pumps directly connected to the prime mover. The high-speed reciprocating pumps, with a great degree of flexibility and good efficiencies, have a high initial cost as well as being subject to vibration and pressure surges. Centrifugal pumps are available in sizes to 6000 hp and are able to pump 340,000 bbl per day at 840 psi differential pressure. These are usually connected in series and result in a flexible head-capacity system. With the advent of a dependable mechanical seal and pump designs able to handle the changing viscosities of the oil stream, many of the prejudices against centrifugal pumps have been removed. Booster pumps are required to provide the proper pump suction head where tankage is used. The advent of completely enclosed weatherproof motors connected to centrifugal pumps makes available an ideal unit well-suited to outdoor installation and resistant to most climatic conditions.

Tanks

The primary use of tanks at stations is to absorb variations in pumping rates and provide some control on the various batches and grades of oil pumped, although the trend toward closed-system operation has greatly decreased tankage requirements. Present tanks are all-welded structures ranging up to 200,000 bbl in capacity. Automatic welding machines have been developed to weld horizontal and vertical seams. The roofs have become floating structures that rise and fall with the liquid, minimizing corrosion and fluid evaporation losses.

The ever-present problem of hydrocarbon evaporation loss has received considerable attention from the oil industry. The establishment in 1953 of the Evaporation Loss Committee of the American Petroleum Institute should provide an effective means for rationalizing all available information and point the way to an effective solution. The development of tank-breathing devices, vapor-recovery systems, and plastic foam are only a few of the many methods now being used to combat evaporation loss.

Another of the many problems is the accumulation of basic sediment and water (BS&W) in tanks. Agitation by electric tank mixers and directional nozzles has helped to provide effective control.

For underground storage of gas and liquid hydrocarbons, artificial and natural caverns have received considerable attention; but they are not at present used by crude-oil pipe lines. The evaluation of the plastic tank, now available in the smaller sizes, may be tomorrow's answer to the problem of tank corrosion and other incrustation build-up.

Construction

Many new innovations in construction have been made in the past few years.

Weather

Perhaps the largest indeterminate factor on a major pipe-line project is the weather. A competent meteorologist, by preparing short and long-range forecasts, can define weather criteria for various construction areas and thereby promote maximum utilization of manpower and equipment.

Aerial Surveys

Aerial surveys are becoming more widespread yearly.

A new tool called the Air-Borne Profile Recorder, or APR, has shown excellent results in mapping and survey jobs on proposed lines through mountainous or broken country.

Many companies have made considerable savings with a new drafting method whereby aerial photographs can be transposed directly onto a drawing of the pipe-line alignment sheets.

Welding

Almost all pipe is now welded by the stovepipe method (position welding) using internal line-up clamps for diameters greater than 12 in. These are usually manually shielded arc welds. When possible, larger-diameter pipe is double-jointed by using a submerged arc weld. On thin-walled material the inert-arc weld has shown

superior strength, but as yet has not been adapted to field use. In welding the higher-yield large-diameter thin-wall pipe, the use of higher-tensile low-alloy welding rods, preheating, and postheating have resulted in field welds less susceptible to thermal cracks. Pressure welding has been used on some lines.

Radiographic inspection of the welds has become increasingly popular and recognized as an efficient and acceptable method. X ray, radium, iridium, cobalt, and other radiographic isotopes are used as a source of radiation. The rapid acceptance of radiographic inspection is evident when the 82 miles of line inspected in 1945 is compared with the 12,515 miles inspected in 1953.

Corrosion Mitigation

Corrosion, one of the major problems in pipe lining has been treated extensively in current literature. The usual standard coatings derived from petroleum residues or coal tar have been used widely for a number of years. Other materials which have been investigated and tried with some success are the synthetic resins and ceramics. Lightweight and perforated-felt outerwraps have been developed to protect the base coatings further. In some installations the line has been wrapped directly with newly developed plastic tapes.

In underwater installations, where weight is a factor in addition to corrosion, concreted coatings have gained widespread use. A standard enamel coating and sometimes an outerwrap is first applied, and the pipe is then wrapped with a wire reinforcement. An extremely dry dense concrete mix is placed by impact on the pipe. This method produces a well-consolidated covering in any desired thickness up to 3 in. and weighing up to 200 lb per cu ft, depending on the aggregate used.

The problem of internal corrosion in existing lines, particularly in the sour-crude areas, has been approached with the use of a controlled scraper program, and in some instances by using inhibitors. An innovation is to coat the pipe internally with a continuous film of plastics.

For new gathering-line installations the use of plastic pipe, highly resistant to most corrosive mediums, has produced considerable interest. The pipe is lightweight, can be cut with a wood saw, and is extremely simple to lay. Its flexibility allows the pipe to follow easily the contour of the ditch. The lengths of pipe are joined by cementing them together in a sleeve. Present disadvantages are its higher cost per foot, greater care in handling, low service-pressure rating, and its susceptibility to being damaged while in service.

Pipe-Line Operation

Of all the basic industries, pipe-line companies probably have the highest capital investment per employee. Because of the nature of its operation this investment is spread over a large area. The economic operation and maintenance of such large systems require the diligent attention of competent personnel. Every effort is made to provide them with the latest available equipment to maintain a safe, continuous, trouble-free operation.

Communications

The telegraph and telephone have performed admirably but are slowly being augmented by a new communication tool called microwave. From its first pipeline application in 1949, covering 70 miles, it has grown to about 10,000 miles in 1953. The large number of available circuits in a microwave system permits the use of VHF control, remote control of pump stations, and telemetering—all in addition to normal voice service.

Dispatching

The use of reliable communication facilities, telemetering, remote controls, and supervisory systems provide the dispatcher with effective tools to co-ordinate all operations. Dispatching boards, a graphic and schematic reproduction of the pipe-line system using movable colored tapes to simulate the various oil batches, show the progress of the petroleum through the lines and provide an instant visual and mathematical check on all movements and operations.

The use of gravitometers and radioactive tracers has made possible the positive location of the interface. The gravitometer gives a continuous record of the density of the passing oil stream and instantly indicates any variations in the gravity. Radioactive isotopes in the stream provide another method for locating the interface and allow instant detection through the walls of the pipe with the use of Geiger tubes. These radioactive tracers also provide a means of starting and stopping automatic booster stations. The detection tubes are placed upstream from the station. The signal from the tubes is telemetered to the station to start and stop the pumps.

Automatic samplers are used to obtain a representative composite sample of the various batches at reception and delivery points. These samples are normally used to determine the BS&W level and the gravity of the oil for custody transfer. Once set, these instruments operate automatically and meter a minute amount of crude oil into containers over a long period of time.

Fluid Flow

Because of larger diameter, an accurate knowledge of flow characteristics is imperative. Since the sizing of lines, machinery, pumps, and other equipment is dependent on the initial theoretical hydraulic study, accurate evaluation is a "must" for economical design. Extensive studies of flow phenomena in larger lines has resulted in a hydraulic slide rule that has simplified the many laborious calculations.

Extensive investigations into the transportation of heavy viscous crudes have developed ingenious methods of heating the pipe lines with electricity or steam. Injection of casing-head gasoline and other light hydrocarbons into the crude-oil stream has helped to reduce pumping power requirements. Control of the mixture is provided by vapor-pressure recorders. With some of the extreme viscous crudes, visbreaking and thermal cracking have been investigated and have proved partially successful. One company has patented a method whereby water in conjunction with an inhibitor is injected into the stream, reducing the crude viscosity to $^1/_{10}$ of its former value.

A new analytical tool called the McIlroy pipe-line network analyzer is being used for network calculations. This unit enables flow and pressure-distribution analysis to be made of complex pipe-line networks in $^1/_8$ of the time normally required by established numerical trial-and-error methods.

Measurement

Recent years have witnessed the widespread acceptance of automatic measuring devices on many pipe-line systems.

The various committees of the ASME, API, ASTM, and others have done a tremendous task in evaluating and standardizing equipment and procedures, as well as in developing acceptable codes.

The automatic tank gage with its associated remote-transmission system has gained widespread use and has been adopted by the oil industry for buying and selling crude oil on a mutual-agreement basis. Of these gages, the float-actuated type and the surface-scanning type probably have received greater attention than most of the other gages. The float-actuated type of gage measures a change in liquid level as a function of float travel. The surface-scanning gage uses an electric sensing element which detects changes in liquid level by an unbalanced electric circuit. With a remote-transmission system, these gages can be read at distant points removed from the tank.

With the new designs and procedures developed in the past few years, the positive-displacement meter has been accepted to measure liquid hydrocarbons accurately. The joint ASME-API Committee on Volumeter Research has established a code of recommended practices which is under constant study and revision to keep abreast of current best practices.

Considerable interest has been shown in a newly developed linear bidirectional flowmeter that measures the true mass-rate of flow independent of the pressure, density, temperature, or viscosity of the flowing liquid.

Electrical averaging resistance thermometers have been developed to measure the average temperature of a volume of oil in a tank. Certain metals have the property of changing their electrical resistance uniformly with temperature; and, because of the stability of their temperature coefficient of resistance, they may be used to measure temperature. Since remote transmission of temperature readings is possible, automatic tank gages augmented by electrical averaging resistance thermometers provide a simple safe method of gaging tanks.

Control Systems

Pipe-line operating techniques have changed drastically with the advent of adequate control instrumentation. The use of automatic controls has reduced manpower requirements and helped to eliminate the human error. By telemetering and supervisory systems, transmitted by telephone or microwave, stations can be monitored and operated remotely. Flow, pressure, temperature, and abnormal operating conditions can be checked from distant points. Sequence relay controllers permit push-button operation of units. Pressure and flow measurements are made with electric-strain-gage pickups. Motor-operated valves are opened and closed automatically. Flow and pressure controllers now position discharge-control valves to maintain suction and discharge pressures within set limits to maintain a constant flow. Automatic protective shutdown devices completely protect the station against abnormal or emergency conditions. The trend is to provide adequate controls with the emphasis on simplicity.

The Future

Many of the technological advances mentioned have been tested and tried; others are still in the experimental stage and will require continued efforts to carry them to a satisfactory conclusion. Many current problems—such as elimination of pressure surges, brittle fracture of steel, and cavitation, to mention a few—still await a satisfactory solution. All of these have presented a formidable task to the pipe-line industry. But with the continual application of sound engineering and typical American ingenuity, these problems should present no greater hurdles than have been overcome in the past. It is difficult to visualize what the next new development will be, but if it results in better transportation of petroleum and its products, it will in all probability have its first application in the pipe-line industry.

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Petroleum Refining[6]

During the first postwar years the refining industry was concerned mainly with expansion and improvement of processes which had already been commercialized. More recently, however, the initial installations for a number of new processes have been made. As yet, relatively little detailed information on the mechanical-engineering features of these plants has been made available. Nevertheless, it may be of interest to describe these processes briefly in order to indicate today's trends in petroleum processing.

In the development of modern refining processes and equipment the roles of the mechanical and the chemical engineer are interdependent, and it is safe to say that neither could carry such projects to completion without the aid of the other.

Catalytic Reforming

Much of the attention has been devoted to the problem of upgrading straight-run naphthas and gasolines to produce motor fuels of the octane quality needed in present competitive markets. Catalytic reforming of naphthas is not new—the first commercial installation of the Hydroforming process was made in 1940. Several plants for this process were built in the next few years and produced the bulk of the synthetic toluene for explosives during World War II. Thereafter, a shortage of benzene and an increasing demand for higher-octane motor fuels revived the interest in such operations.

The first of the postwar reforming processes to achieve prominence was Platforming, developed by Universal Oil Products Company. It is reported that there are 71 units in operation or contracted for (1).[7]

There are also several other processes which employ a catalyst containing platinum in a static bed. These processes represent approximately two thirds of the total catalytic-reforming capacity installed in the United States.

Catforming, developed by the Atlantic Refining Company, is now in commercial-scale operation (2). As of September, 1953, four plants of from 750 to 2500-bpd capacity had been completed (3) and recently an 11,000-bpd unit has gone into operation (4).

"Houdriforming" is the designation given by the Houdry Process Corporation to its fixed-bed reforming process. Three plants are reported to be under construction (5), one of which of 11,500-bpd capacity is nearing completion (6).

A fourth process, which uses a platinum catalyst developed jointly by Sinclair Research Laboratories and Baker & Company, will be employed in plants of 3000 and 16,000-bpd capacity scheduled for completion in the summer of 1954 (7).

The foregoing processes all operate at elevated pressures, generally in the range of from 200 to 750 psig and at temperatures of 850 to 975 F. All employ recirculation of hydrogen-rich product gas and operate either continuously or over relatively long reaction periods.

One other fixed-bed platinum-catalyst process, for which three units ranging from 6800 to 21,000 bpd have been announced, is Ultraforming (8), developed by Standard Oil Company (Indiana). It differs from the previously described processes in that facilities are provided to permit regeneration of the catalyst without interrupting the reforming operation.

While there is little published information available on the mechanical features of these processes, the more important design problems appear to be the design of the reaction vessels for the operating conditions of temperature, pressure, and hydrogen concentration; compressors for recycling of the product gas; and, in the case of processes involving cyclic operations, the selection of suitable valving arrangements to isolate the reaction and regeneration systems.

Apart from the fixed-bed processes there are also several in which the catalyst is circulated through reaction and regeneration zones either as a fluidized powder or as granular or pelleted material. The first of such units to go into commercial operation was a 2500-bpd Fluid Hydroformer. This process, developed jointly by the M. W. Kellogg Company, Standard Oil Company (Indiana), and Standard Oil Development Company, is, as the name implies, the application of the fluidized-catalyst technique to the original Hydroforming process. Operating conditions for the process are in the vicinity of 250 psig and 920 F; recycling of hydrogen-rich product gas through the reaction zone is practiced. A molybdena-alumina catalyst is used as a finely divided powder (9). It has been announced that four other units ranging in capacity from 12,500 to 30,000 bdp are in various stages of design and construction. Both the reactor and regenerator vessels of the first unit are fabricated of carbon steel and are internally insulated with a refractory lining. The excess heat of combustion in the regenerator is utilized to generate 250-lb steam by means of boiler tubes partially submerged in the catalyst bed. The regenerator temperature is controlled by varying the bed level. One novel departure from usual fluid-catalyst practice is the use of filters in the top of the regenerator to prevent loss of catalyst in the flue gas (10).

Much as Fluid Hydroforming incorporates certain of the features that originated in the Fluid Catalytic Cracking process, so Thermofor Catalytic Reforming, a development of Socony-Vacuum Oil Company, parallels the T.C.C. process in the use of the moving-bed principle (11). One 3000 and two 19,000-bpd plants have been announced.

A second moving-bed reforming process, Hyperforming, has been developed by Union Oil Company of California. It is stated that a cobalt-molybdate catalyst is used and that the process is capable of handling cracked stocks as well as those high in sulphur compounds. The process operates in the range of 800 to 900 F and at 400 psig pressure. The process employs "Mass Flow" or "Hyperflow," a dense phase-lifting system (12). Regeneration is carried out by circulating flue gas with an oxygen content below 2 per cent (13). A small commercial unit is expected to go into operation during the latter part of 1954 (14).

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[6] By J. S. Rearick, Manager of Engineering, C. W. Nofsinger Company, Kansas City, Mo. Mem. ASME. (Condensed from ASME Paper No. 54—Mex-22.)

[7] Numbers in parentheses refer to the Bibliography at the end of this section.

Continuous Coking

A second phase of refining technology that has received much attention recently is production of catalytic-cracking feed from residual stocks. This is due both to increasing demand for the former and lack of markets offering adequate return for heavy fuel oil. Of particular interest is the Fluid Coking process, announced by Standard Oil Development Company last year. The construction of three plants employing this process has been projected. It utilizes a circulating coke stream in a finely divided form. The seed coke, which must be of smaller size than the product in order to maintain a constant particle-size inventory, may be produced by grinding a portion of the product coke (15).

Desulphurization

A third field of interest in the refining industry is the desulphurization of middle distillates. This is the result of the increased use of high-sulphur crudes and the growing demand for diesel and light fuel oils. Two processes announced last year fall into this category.

Unifining, developed by the Union Oil Company of California, is stated to be particularly adapted for treatment of partially cracked stocks containing refractory sulphur compounds (16). Operating conditions are in the neighborhood of 800 F and 450 psig, with recycle of hydrogen-rich product gas after removal of hydrogen sulphide. Because of the exothermic nature of the reaction, no heat need be supplied after the start-up period. Construction of a 15,700-bpd plant has been reported (17).

In the Shell Hydrodesulphurization process the feed is not completely vaporized, but "trickles" down in a thin film over the catalyst. This technique permits the use of lower recycle-gas quantities and temperatures. The preferred operating conditions are pressures of 600 to 750 psia and temperatures of around 700 F. It is stated that removal of hydrogen sulphide from the recycle gas is unnecessary. A commercial unit employing the process is reported under construction (18).

Mention should also be made of Autofining, developed several years ago by the Anglo-Iranian Oil Company, which, unlike the foregoing two processes, does not require an extraneous source of hydrogen. One 500 and one 3500-bpd plant are reported to be in operation in England (19).

Catalytic Cracking

Modifications of the older catalytic-cracking processes which have been incorporated in recent units are worthy of consideration.

Houdriflow, developed by the Houdry Process Corporation, represents a modification of the moving-bed catalytic-cracking process in which a pneumatic lift is substituted for mechanical elevators used to transport the catalyst. In addition, the reactor is superposed upon the kiln and the two are built as a common vessel (20).

Another innovation is the "package-design" T.C.C. Unit developed by Socony-Vacuum and Southwestern Engineering which also employs an air lift plus gravity flow to transport the catalyst (21).

In the fluidized-catalyst operation new designs have also been brought out. The Orthoflow, developed by the M. W. Kellogg Company, involves the construction of the reactor and regenerator as a common vessel with the catalyst lines so arranged that the flow is in a straight line. In order to accomplish this, it was necessary to design special catalyst flow-control valves which could be located inside the vessel (22). Eleven of these units are in operation or under construction. This resembles an earlier Universal Oil Products Company design which also featured the combined reactor-regenerator but utilized external-catalyst transfer lines (23).

A different modification of the fluid-catalyst process, known as Model IV, originated with the Standard Oil Development Company. Here the separate reactor and regenerator have been retained, but in place of the conventional low-density catalyst transfer system, "U" bends are employed with sufficient aeration medium introduced in the upflow leg to produce a difference in density and thus induce flow in the desired direction. Velocities in the reactor and regenerator have also been increased with a resultant reduction in the diameter of these vessels (24). It is reported that there are some 20 of these units either in operation or under construction.

Another development is a novel steam boiler integrated with a Fluid Catalytic Cracking unit recently installed by the Sinclair Refining Company. This boiler is intended to utilize not only a portion of the sensible heat in the flue gas leaving the regenerator, but also the heat of combustion of the carbon monoxide contained therein (25). Under design conditions the boiler gets approximately one third of its heat from each of these sources and the other third from gas fuel. The flue gases from the regenerator are mixed with auxiliary fuel and air in a pressurized furnace and brought to combustion temperature and then pass into a second pressurized furnace equipped with a water wall where combustion is completed. Steam is generated in a single-pass two-drum boiler and heat is recovered from the exit flue gases in an economizer, both of which are pressurized. No superheater is provided in the boiler, but instead a four-stage series superheater is immersed in the catalyst bed in the regenerator. Since provisions are made for control of steam temperature between stages, a method for control of regenerator temperature is thus afforded.

Combination Processing

A notable development is the trend toward combination processing. In 1933 the first combination thermal-cracking unit, designed as such, went into operation. This combined crude distillation with various thermal-cracking operations on the fractions thus produced together with treatment and stabilization of the gasoline product. Units of this type operated substantially without intermediate storage facilities and were adopted widely in the industry.

The trend in this direction was interrupted by the introduction of catalytic processing and the extremely rapid expansion of such facilities which followed the outbreak of World War II. Because of the new and largely untried nature of these processes, and the likelihood of improvements and modifications in the near future, it was logical to design them as isolated units. In the postwar period, however, attention was again focused on the advantages of integration.

Currently, in most cases new refineries are being de-

signed on this basis, and its influence is being felt in many modernization and expansion programs. A number of these modern combination plants are now in successful operation and others are under construction (27).

Recent economic studies have indicated savings on the order of 20 per cent in investment and 10 per cent in operating cost for the combination plant versus individual units (27).

Process Control

Significant changes are also occurring in the field of process control and instrumentation. With the advent of integrated units, centralization of the control of an entire refinery in a single control room became essential. This gave a powerful impetus to the development of miniature instruments and graphic panels, which permitted a clear pictorial representation of the process within a reasonable area, as well as improved control systems, both pneumatic and electronic, to minimize transmission lags. These same factors also have led to the substitution of scanning and monitoring systems in place of manual checking of process temperatures and other variables. Another important trend is the increasing use of devices which measure product quality directly and continuously for process control, instead of dependence on spot analyses carried out in the laboratory (28).

Electric Drives

Although the use of electric-motor drives for pumps and other small equipment have been standard practice for some years, spare units powered by steam were usually provided for critical services. It is not surprising, therefore, that on the early catalytic units steam-turbine drives were selected for the air blowers and similar equipment, which, because of its size, could not economically be spared. However, during recent years there has been a growing tendency to consider electric-motor drives for such services where an adequate and dependable source of electricity is available (29).

Maintenance Organization

Present high labor and material costs and strongly competitive markets for petroleum products have combined to create a powerful incentive for minimizing maintenance costs and increasing on-stream time. Much attention has been given to the development of suitable organization and procedures to cope efficiently with both routine maintenance and major turnarounds. Particular emphasis has been placed on the necessity for detailed advance planning in connection with the latter in order to reduce down time to a minimum (30). Likewise, there has been a growing realization of the part that can be played in accomplishing these objectives by placing adequate power-driven tools in the hands of the maintenance man (31). Various ingenious techniques have been devised to repair equipment without shutting it down (32). One result of the foregoing has been the increased efforts which are being made by the designers of refinery units to facilitate maintenance of the equipment.

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A Periodic Re-Evaluation of Manufacturing Processes

Your manufacturing process depends on a systematic organization and procedure to keep it efficient, up to date, and economical. This paper presents such a three-point re-evaluation program.

By Walter H. Friedlander

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ALL manufacturing operations require periodic changes to eliminate sporadic trouble spots or to permit engineering changes in material, tolerances, or heat-treatment. Nevertheless, major benefits cannot be derived by changing, or perhaps modernizing, individual operations. Often, minor changes in specification should logically be accompanied by a major revision of the process. Unless the entire line is re-evaluated from receiving to shipping, possible major savings in manufacturing cost may never be realized.

Schedule increases over a period of time may have been accomplished by doubling up on low-production equipment. The possibility must be investigated periodically of doing the job with special machinery. Conversely, reductions in the operating schedule may have left a great deal of expensive, special-purpose equipment around idle. The economic feasibility of selling or shifting this equipment and obtaining standard machines to do the job should be looked into. Only a systematic, periodic re-evaluation will bring these problems to light.

A procedure for handling this re-evaluation is incorporated in the following three points:

1 Plan: A systematic plan for re-evaluation.
2 Organization: Who will be responsible for the re-evaluation.
3 Follow-up: Execution of the re-evaluation study.

Plan for Re-Evaluation

The plan for review concerns itself mainly with determining the frequency with which established lines should be gone over and, of course, depends on the component as well as the schedule. It is suggested that all major lines be investigated from the standpoint of methods and processing every one to two years, and from the standpoint of equipment, every three to five years.

The study itself must encompass the entire manufacturing process from receiving to shipping and is best carried out in two stages: (*a*) an investigation of the records, and (*b*) a check on the production floor of actual methods and facilities. In this manner a comprehensive picture can be obtained.

First, the operations sheets should be checked and a flow chart of the sequence of operations prepared to see if operations can be combined, reshuffled, or eliminated with a view toward saving equipment. Next, a check must be made of the tool setups and tool prints to gain a complete understanding of present part manufacture. When available, tool-life records should be looked into to find spots where undue tool wear or tool breakages occur. The inspection records should be checked to find major causes, frequency, and amounts of rejection and rework. The part print should be gone over in detail and engineering changes must be studied to see if recommendations can be made concerning material specifications, tolerances, and surface-finish requirements. A recommendation to change the material, for instance, might call for the substitution of a free-machining steel. Possible changes in tolerances and finish requirements may ease manufacturing problems and reduce the number of rejects. In addition, the standards must be evaluated to check job procedure. Finally, plant layout must be studied and equipment maintenance records must be obtained. The latter will influence decisions regarding possible machine replacement and recommendations concerning preventive maintenance.

Next, the study concerns itself with an investigation of facilities and actual methods on the production floor. Here, layout must be checked again for accessibility, aisle space, and parts-in-process handling and storage facilities. Then the equipment must be gone over to obtain an idea of the accuracy that can be obtained with machines and man-machine combinations. A line foreman, for instance, might have enough equipment to meet schedule on paper, but it is quite possible that he can use only a fraction of his machines for accurate work which may comprise the bulk of his load. Next, a check must be made to see if the operations sheets are up to date and being followed, and if each job is done as set up in the standard. Also, tool supply and tool grinds should be investigated, and production gages and inspection methods must be correlated with those of the inspection department so that maximum uniformity can be attained. At times the inspection methods employed by the production and inspection departments may vary to such an extent as to cause large amounts of rejection.

During this time, interviews should be held with all of the personnel affected to bring out difficulties and to obtain their ideas on possible improvements. When all of the data have been collected, an analysis must be made. Then a report, complete with cost estimates, should be prepared and presented to the general manager for review.

Organization for Re-Evaluation

To obtain a fresh viewpoint, either an outside consulting firm or a separate company department can be utilized. In either case, the organization group must work for top management since it must have the necessary backing

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to put changes into effect. Members of the group each should be responsible for the re-evaluation of a different line. They must be responsible for collecting the data, making recommendations and cost analyses, and the supervision of the follow-up. The work of the members of the group can be co-ordinated by a separate supervisor responsible to the general manager.

Re-Evaluation Follow-up

So far, a report has been prepared containing recommendations. The task of translating these recommendations into effective improvements requires the co-operation of all the departments affected. This is best done by giving the report to a committee consisting of representatives of each of these departments. Each representative can act as liaison engineer to his particular group. If, for instance, it has been recommended to loosen the tolerance on a certain dimension, the engineering representative can expedite the engineering change request. Similarly, if critical cutting-tool shortages have been discovered, the tool-control representative can investigate inventory practices and expedite the tools through the grinding room.

In some instances, the facts presented in the report will call for an additional investigation. The report may state, for example, that a great number of pieces are rejected for finish at a certain operation. A further investigation may reveal that the pieces actually are marked by the inspection gages and that the operation is not at fault. Then again, the feasibility of new ideas will have to be tried out before the suggested revisions can be put into effect on the production line. This can be accomplished in several ways. The job can be set up in the toolroom or the experimental department, or manufacturing can release a machine to the committee for development purposes. Then again, if the size of the project warrants it, a separate pilot manufacturing line can be set up.

Basically, the component must be handled as a new part. The piece must be turned back to production engineering to be reprocessed as recommended. If new equipment or tooling has to be obtained, steps must be taken to place the necessary orders. Plant layout must reconsider the area affected in the light of new developments. Time study can make new estimates or schedule the taking of new studies.

Proper operator training is an important factor in executing the recommendations. The use of new tools and methods and the correct speeds and feeds requires close initial supervision. In addition, the fact that most operators will be asked to increase production without an increase in pay requires diplomacy and salesmanship. The line foremen, usually, are too bogged down with paper work to be able to handle this function. It is best handled by the representative from the re-evaluating organization who also is responsible for the co-ordination of the over-all program.

Cost-Saving Examples

Consider the shaft shown in Fig. 1. The material specification calls for an SAE 8640 forging. When the part first was designed, it was the smallest of a series of three components which were manufactured from the identical forging. Over the years, the company obsoleted the first two shafts; nevertheless, they continued to make this one from the old forging. This condition is not unusual in industry.

The original hardness specification called for Rockwell "C" 34–40 all over. Production continually complained about this specification because hardening the part after it was finish-machined, except for grinding and threading, caused warpage in the thread hole and a high scrap rate. The part was reamed prior to thread-milling, but the distortion was such that in many cases the hole did not clean up. Engineering finally reconsidered the part and came up with a hardness specification of Rockwell "C" 26–32 on the thread end only. Otherwise, the forging was to be left as normalized. Manufacturing engineering then changed the heat-treating procedure accordingly, going from a through-hardening operation to an induction-hardening operation on the thread end only. This operation was substituted without a change in the sequence of operations. Some warpage still was encountered, though on a greatly reduced scale. The scrap picture was much improved.

The thread-milling operation was instituted originally because of the hardness of the piece and because of the accuracy which had to be held. Since the part had to be relocated for reaming and then again for threading, so much of the manufacturing tolerance was used up in locating as to make the consideration of tapping impractical. The sequence of operations prior to and after the re-evaluation is shown in Figs. 2 and 3.

A complete analysis of the process disclosed the follow-

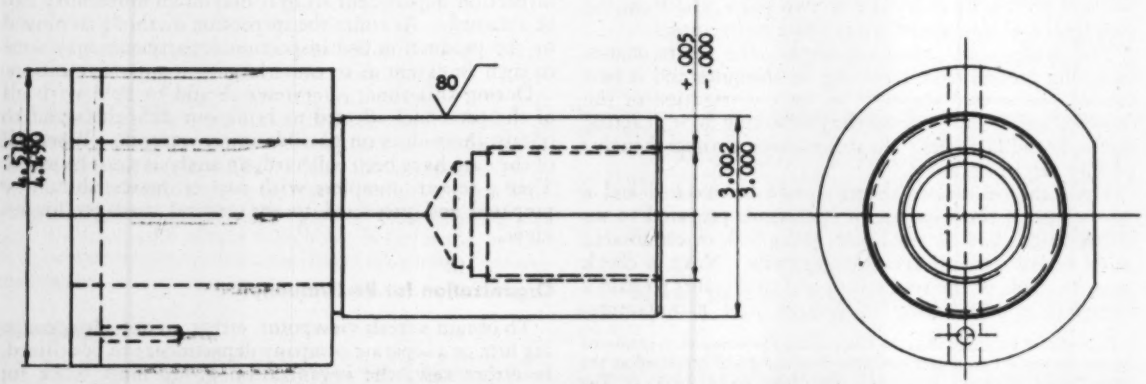

Fig. 1 Drawing of shaft used in re-evaluation study

ing possible simplifications: First, the forging should be changed to conform closely to the shape of the part that is made from it. This change can go into effect when the next new dies have to be made. Then, the induction-hardening operation can be eliminated, and the part hardened all over right after normalizing. It is then possible to eliminate the grinding, reaming, and thread-milling operations.

Instead of OD grinding the part, it is carbide-turned while chucked on the large OD in a turret lathe. This

Operation No.	Operation Name	Machine	Department
5	Receive material		Receiving
10	Inspect		
15	Normalize		Heat-treat
20	Inspect		
25	Chuck on small OD, R & F turn large OD, and face end	Turret lathe (1)	General shop
30	Chuck on large OD, R turn, face end and shoulder, neck, drill, counterbore, chamfer, countersink	Turret lathe (2)	General shop
35	Inspect		
40	Mill side	Hor. milling mach.	General shop
45	Mill slot	Hor. milling mach.	General shop
50	Drill ¼-in. hole	Upright drill press	General shop
55	Inspect		
60	Induction-harden thread end	Induction-hardening	Heat-treat
65	Electrolytic clean		Heat-treat
70	Inspect		
75	Grind small diameter	OD grinder	General shop
80	Inspect		
85	Ream bore	Upright drill press	Gear department
90	Mill thread	Thread miller (2)	Gear department
95	Inspect		
100	Final inspect		
105	Slush		
110	Stores		Finish stores

Fig. 2 Sequence of operations on shaft prior to re-evaluation

Operation No.	Operation Name	Machine	Department
5	Receive material		Receiving
10	Inspect		
15	Normalize and harden R_c 26-32		Heat-treat
20	Inspect		
25	Chuck on small OD, R & F turn large OD, and face end	Turret lathe (1)	General shop
30	Chuck on large OD, R turn, face end and shoulder, drill, and chamfer	Turret lathe (1)	General shop
35	Inspect		
40	Mill side	Hor. milling mach.	General shop
45	Mill slot	Hor. milling mach.	General shop
50	Drill ¼-in. hole	Upright drill press	General shop
55	Inspect		
60	Chuck on large OD, finish turn, counterbore, countersink, and tap	Turret lathe (1)	General shop
65	Inspect		
70	Final inspect		
75	Slush		
80	Stores		Finish stores

Fig. 3 Sequence of operations on shaft after re-evaluation

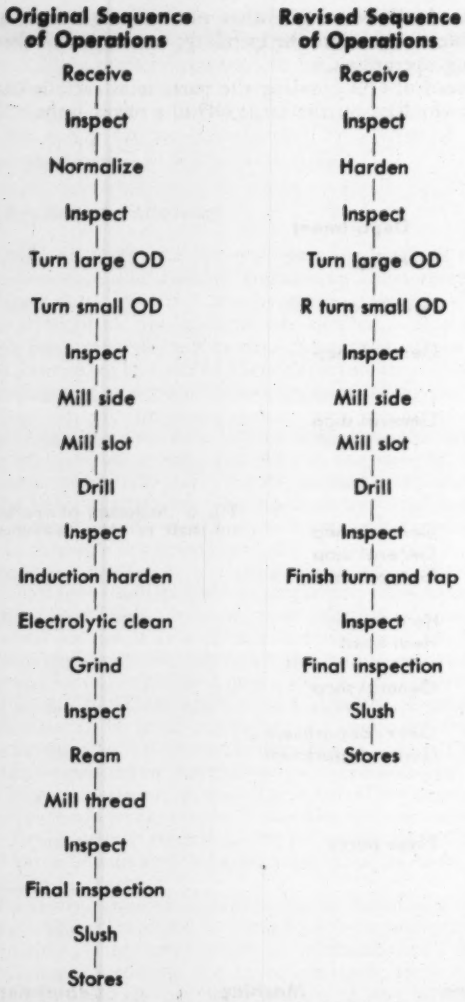

Fig. 4 Flow chart showing original and revised sequence of operations

also eliminates the necking operation during prior turning as the shaft was necked only to facilitate the grinding. The shaft is counterbored and tapped during the same operation, assuring the required concentricity and accuracy. The part was reamed previously to take care of distortion in the thread hole and the new processing eliminates the reaming. Tapping the thread at first proved difficult, but a separate project was set up to develop a tap and carried successfully to completion.

It will be seen that the part is finish-turned late in the process. This is done to prevent damage to the finish and thread during prior handling operations. Furthermore, when this is done the old fixtures for operations 40, 45, and 50 can still be utilized since the old processing called for grinding stock on the part.

Flow charts can now be used to evaluate the savings. Fig. 4, showing the original and revised sequence of operations, indicates that six operations have been eliminated, namely, the grinding, reaming, thread milling, cleaning, and two inspection operations. Furthermore, an OD grinder, a drill press, and two thread millers have been replaced by one turret lathe. This is one of the two machines previously used for turning the small OD. It must be remembered that the forging change has reduced turning time appreciably and that the neck has been eliminated. As far as handling is concerned, Fig. 5 shows that only four major moves occur under the present routing compared to the seven moves previously required.

Other Cost-Saving Examples

In another instance, a great deal of difficulty had been experienced in setting up a certain line originally. The part was new and unproved and extremely close tolerances were required. To make things worse the manufacture of the part called for the machining of two difficult contours. As time went on and engineering

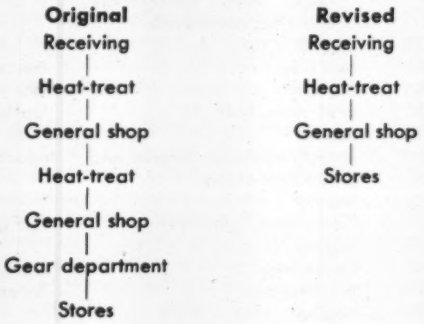

Fig. 5 Flow chart showing savings gained in materials handling

gained some experience with the part, the tolerances were loosened. This immediately reduced the scrap rate and everyone concerned felt much better. Nevertheless, manufacturing continued to use the expensive process that had been developed initially to make the part to the original tolerances. A complete re-evaluation of the process resulted in the elimination of 20 per cent of the operations and machines required to make the part and resulted in an appreciable cost saving. Most of the machines released could be used in other areas of the plant.

Another time, a process analysis showed that a hand-chipping operation requiring several minutes was holding up the line. It was found that an additional tool applied during a previous automatic turning operation could produce an undercut that would eliminate the manually-paced operation. Since the undercut was placed on a locating surface that was machined off anyway, the change was acceptable to engineering. The saving amounted to $50,000 per year.

Conclusions

Experience has shown that large savings in time, equipment, and personnel can be realized through the application of this type of survey. A periodic re-evaluation of the manufacturing process tends to lead to a modern plant with minimum production problems and costs.

Continuous Gravimetric Proportioning Systems

By R. P. Lowe

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Continuous gravimetric proportioning may be defined as controlling the weight rate of a continuous flow of multiple components to a process so that a constant proportionality is maintained. Systems designed to accomplish this are gaining in industrial popularity to such an extent that some understanding of basic principles is in order to guide the engineer in the selection of apparatus and methods best suited to the solution of a given set of job conditions.

The basic principles which govern the design and performance of continuous gravimetric proportioning systems are demonstrated in Fig. 1, which shows the elements of four system types. All machines for this service are essentially the same in principle, with variations in details of control. The basic elements are as follows: (*a*) Load-detecting and supporting means; (*b*) load-reducing and transmitting devices; (*c*) counterbalancing element; (*d*) control device.

Item (*a*) may be a suspended hopper, tank, or storage cylinder, a weighing platform, or a traveling conveyer belt; (*b*) may consist of a lever system and linkage or a hydraulic, pneumatic, or electronic transmission system; (*c*) may be a mechanically driven or automatic counterbalancing means, a hydraulic or pneumatic force-balance system, or an electronic null-balance device; (*d*) would be a control valve, gate positioner, variable-speed unit for controlling a star feeder, conveyer belt, or vibrating feed tray.

General Considerations

Weight is the most accurate of the quantitative measurements because it depends on the force of gravity alone and is not affected by either temperature or pressure. Volumetric measurements to be accurate must be corrected to a common standard of temperature in the case of liquids, and temperature and pressure in the case of gases; dry materials are specified in terms of weight per cubic foot, but this value must be corrected for moisture content and particle size.

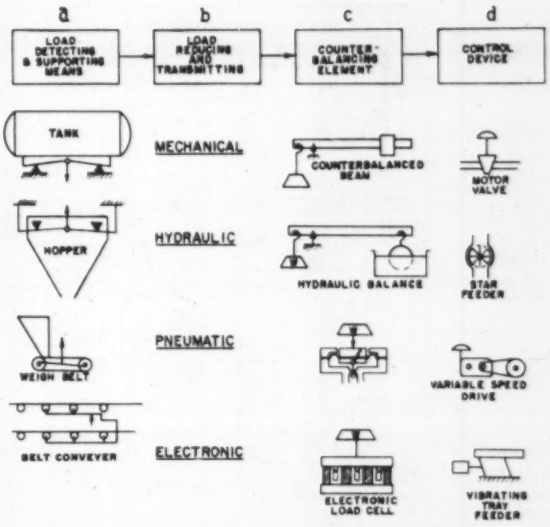

Fig. 1 Continuous gravimetric proportioning systems

Continuous weighing systems as applied to proportioning problems require the handling of either liquid, gaseous, or dry ingredients, and determination of method as well as the selection of equipment will be affected by these considerations. Also there is the question as to whether the material to be proportioned is received in cylinders, drums, tank cars, gondola cars, or ships, or whether it is a product or by-product produced at the site. In each of these cases the materials-handling part of the problem should be analyzed to make sure that storage and transfer facilities are adequate and reliable. The final and most important consideration is based on the value per pound or per cubic foot of the components as well as the end product together with the tolerance of error within which the proportioning operation must be carried out.

Which System to Use?

Job conditions will determine which one of two types of proportioning system is required, namely, constant rate, or flow responsive.

In a constant-rate system the weight rate of finished product is predetermined because the feed rate of one component is maintained constant. In a flow-responsive system the weight rate may vary from minute to minute depending on demand requirements. In either case final results will be affected first by the accuracy within which the pacing system can perform and also by the accuracy within which the weighing and control equipment will function. Some operations require a minute-by-minute proportioning accuracy; others, because of the size of secondary mixing equipment, can use an averaging type system, while still others require only average proportioning accuracy and slight variations in weight rate are permissible.

Reproducibility of settings and results always should be a prime consideration in selecting equipment, and this means that zero calibration and totalizer operation under

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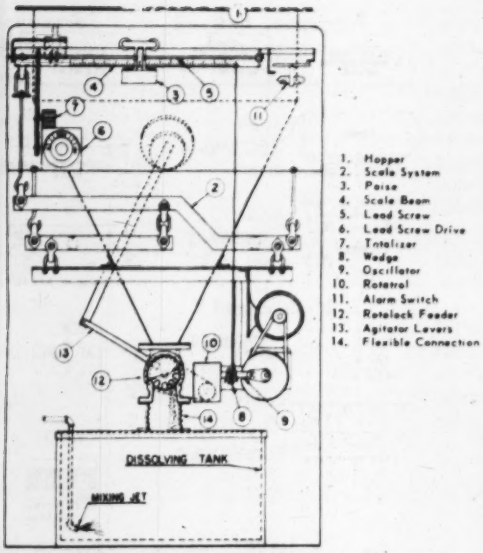

Fig. 2 Diagram of unitized loss-in-weight feeder with roto-lock feeding mechanism

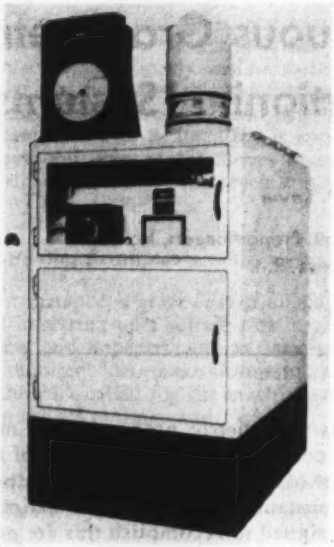

Fig. 3 Complete "packaged" unitized loss-in-weight feeder

dry-run conditions should be possible. Maintenance facilities, location of the equipment, vibration, dust conditions, excessive heat, moisture, corrosive atmosphere, wind, exposure—all contribute to final performance—and proper provisions must be made for protection of all parts of the system from adverse factors. Where such protection is not possible the solution of the problem should recognize the worst condition and the design modified to suit.

Loss-in-Weight Proportioning Systems

Typical Loss-in-Weight Feeder. Figs. 2 and 3 show a loss-in-weight feeder in "package" form. The hopper, load reducing-and-transmitting lever system, counterbalancing means, as well as the control system, are all built into, and enclosed within, a single housing.

This feeder will deliver within $^1/_2$ of 1 per cent of the rate for which it is set regardless of the amount of material in the hopper, varying humidity, type of chemical, or feeding characteristics. Hoppers and beams are made for capacities up to 300 lb and feed rates up to 100 lb per hr. Other models are made with scale beams and hoppers up to 10,000 lb and feed rates of 1000 lb per hr.

Proportioning of TEL and Gasoline. Generally speaking, the base stocks or components start from storage tanks or hoppers and the design of the weighing system is determined by whether the process operation is to be batch or continuous. As an example, in the proportioning of antiknock compound to gasoline, both of which are liquids, the tetraethyl lead (TEL) is received in tank-car lots. Because of the toxic nature of TEL the entire contents of the car are transferred to the storage tank on the proportioning scale at one time. This means that the weigh tank (*a*) may have a capacity of either 60 tons or 110 tons depending on the job requirements; (*b*) the weigh tank must be closed and vented; and (*c*) the operation of tank filling and fluid feeding must be carried on under vacuum.

Fig. 4 shows the flow diagram of a system for the gravi-

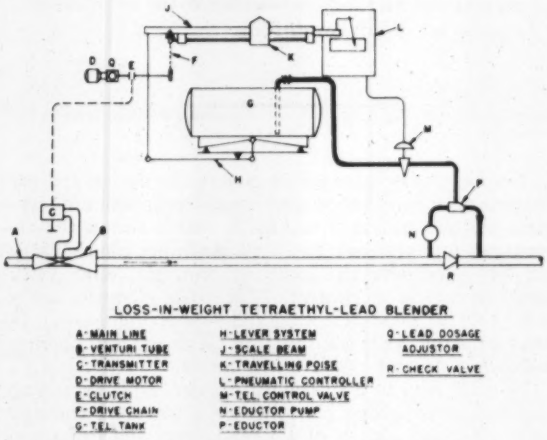

Fig. 4 Loss-in-weight tetraethyl-lead blender

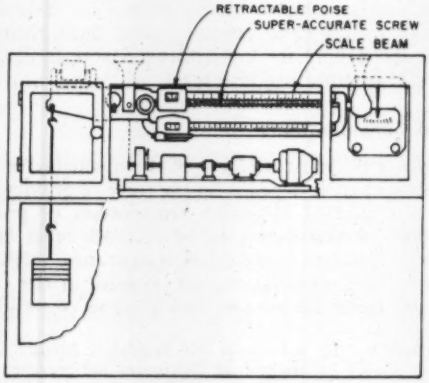

Fig. 5 Loss-in-weight scale

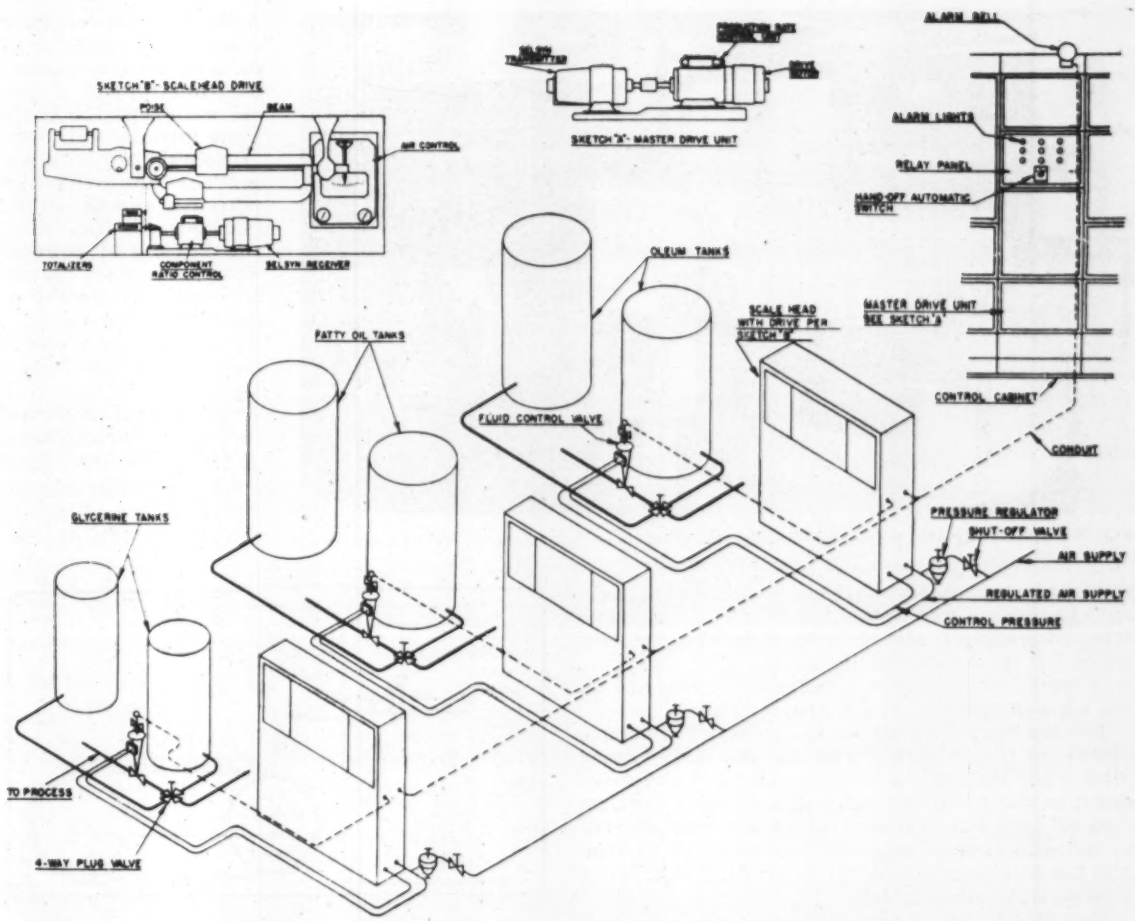

Fig. 6 Group of synchronized loss-in-weight scales controlling continuous feeding of three liquids in preset proportions

metric proportioning of TEL to gasoline. This is a flow-responsive operation because the leaded gasoline usually is delivered to transcontinental pipe line, a tanker, a barge, or tank car, and the gasoline rate is variable. A venturi tube is used to sense the flow of gasoline to be leaded and the differential thus produced is impressed upon a transmitter of either the electronic or pneumatic type, which causes the receiver at the scale to retract the movable poise on the scale beam, Fig. 5, at a rate (in pounds per minute) determined by the gasoline flow in terms of gallons per minute.

Since the operation must be carried on under vacuum, a slip stream of gasoline is passed through an eductor which continually produces a vacuum to raise the TEL through the drop pipe in the tank. The rate at which the fluid leaves the tank is controlled through a diaphragm motor valve with streamlined plug, seat, and inner body to prevent build-up of lead deposits. The control system is of the null-balance type as the scale is in balance at all times. An increase in the flow of gasoline will draw the counterpoise toward the fulcrum more rapidly, causing the scale beam to tend to rise. The upset is picked up by the control instrument linked to the tip of the scale beam which in turn opens the TEL feed valve until equilibrium is restored. A decrease in the rate of flow of gasoline causes the scale beam to tend to fall, moving the control valve in a closing direction. In actual practice the control valve remains in its set position (in so far as the eye can see) unless there is a change in gasoline flow.

This system delivers leaded gasoline with a finished-product accuracy of ±0.03 cc (by chemical analysis) TEL per gal of gasoline with a dosage range of from 0.5 to 3 cc per gal for motor fuel and 2 to 4.5 cc per gal for aviation fuel. Gasoline flow rates are on the order of 500 to 5000 gpm. Needless to say, all equipment for this service must be explosion-proof.

Fig. 5 shows the essentials of the type of scale used for the continuous leading of gasoline. It is commercially known as a loss-in-weight scale and depends for its performance on the superaccurate screw which drives the retractable poise. In null-balance use we have found scales of this type accurate to 1 lb in 10,000 lb.

Proportioning Multiple Liquids. Fig. 6 shows a group of synchronized loss-in-weight scales controlling the continuous feeding of three liquids in preset proportions. This is a constant-rate type of pacing system in which the weight rate of end product is controlled by a variable-speed-driven master selsyn motor. The poise-retracting screw for each one of the loss-in-weight scales

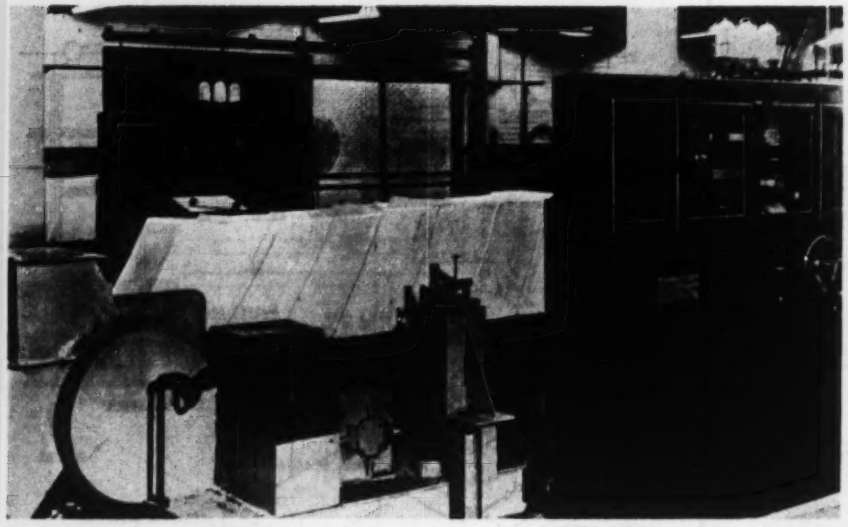

Fig. 7 Loss-in-weight pulp-sheet feeders installed in large Southern cellophane mill

is driven by a secondary selsyn under control of the master. Changes in formulation are made by adjusting an integrating-type variable-speed device between the slave selsyn and the poise-retracting screw. This device has a calibrated accuracy of $\pm 1/4$ per cent of actual feed set and has a straight-line output characteristic.

To make this process continuous each scale is connected alternately to one of two tanks and one tank is being filled while the other is being emptied at a controlled rate. In this particular case each tank has a sufficient capacity for a 4-hr shift, and the transfer from one tank to the other is made manually. However, this system also has been made completely automatic by the use of separate scales for each tank.

Pulp-Sheet Feeding in Alpha-Cellulose Manufacture. Fig. 7 shows two of six pulp-sheet feeders installed in a large southern cellophane mill. The conveyer with its variable-speed drive can be seen behind the scale cabinet. The machine is standardized and can be obtained with either manual or automatic rebalancing. Warning lights above the scale cabinet show a low limit of material on the conveyer when a conveyer is being loaded and when the machine is in normal operation. Note that all scales are completely enclosed to prevent feeding errors caused by stray air currents.

Belt-Type Gravimetric Feeders

Typical Belt-Type Feeder. The belt-type gravimetric feeder, as shown in Fig. 8, is suitable for average feeding rates of from 500 to 20,000 lb per hr. The feeder may consist of a vibratory mechanism having a materials-supply hopper with a built-in shutoff gate, a short conveyer belt suspended from a scale mechanism, and a variable-speed transmission drive for the belt. One type of machine uses an electronic vibratory feeder instead of the type shown which employs a mechanical vibrator. Larger sizes of this machine may use a control gate positioned by the weight of material on the belt.

In general, material flows from the hopper through the adjustable gate to the vibrating feeder tray from which it is discharged onto the weigh belt. In this particular design the vibrating movement is imparted to the tray by a cam-operated oscillator through a rubber wedge which hangs freely from the scale beam between the oscillator jaw and the opposing jaw which is attached to the feeding tray. Thus, when the beam and control wedge are lowered because of insufficient weight of the material on the belt, the amplitude of the feeding tray is increased, causing a greater feed; vice versa, too much weight on the belt tilts the scale beam up and retracts the wedge, thereby decreasing the feed.

Changes in feed rate are obtained by adjusting the

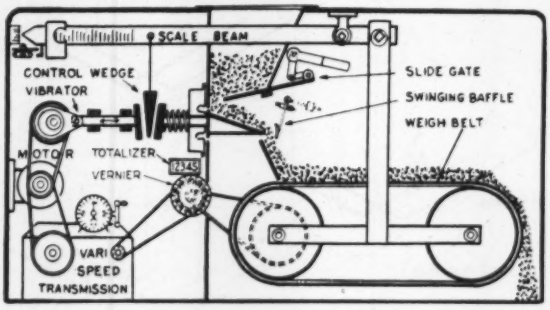

Fig. 8 Belt-type gravimetric feeder

variable-speed transmission to drive the belt at the desired speed when carrying a predetermined load per foot of belt. For example, with a belt travel of 1 fph and a load of 20 lb per ft of belt on the conveyer, the feeder will deliver 20 lb per hr. On the other hand, with the same load per foot and a travel of 100 fph, the feeder will deliver 2000 lb per hr.

Accuracy is identical at the maximum and minimum rates because the same load is being weighed at all rates of feed. For any given material the rate of feed is adjusted by changing the belt speed and not by altering the weight on the belt. The scales and control mechanisms are sensitive to $1/100$ lb. Thus, if 20 lb is being carried on the belt the gravimetric error would be 20 divided by 100, or 0.2 lb, which represents an error of 1 per cent. The average accuracy of a belt-type gravimetric feeder is ± 2 per cent.

Compounding of Fertilizer Mixtures. A typical application for belt-type gravimetric feeders is in the continuous compounding of fertilizer mixtures. Fig. 9 shows a group of such units in a feed mill. All feeders handle the same weight per foot of belt and the variable-speed units which determine feet of belt travel per unit of time are regulated remotely from the respective control panels for each feeder. The operating elements can be seen through reinforced hinged glass panels and

individual feed calibration is made possible by a pants-leg delivery chute at the back of each feeder. This is a streamlined installation of standardized units having interchangeable parts.

Belt Feeders With Pneumatic Load Cells. Fig. 10 shows another counterbalancing means, the pneumatic load cell, developed during the past 10 years. It employs a preformed diaphragm arranged to support the load and to position an air pilot valve as required to support the diaphragm pneumatically in a fixed position for all values of load. Other forms of this same device may have a stack of diaphragms with tare or preloading chambers and external or internal dashpot.

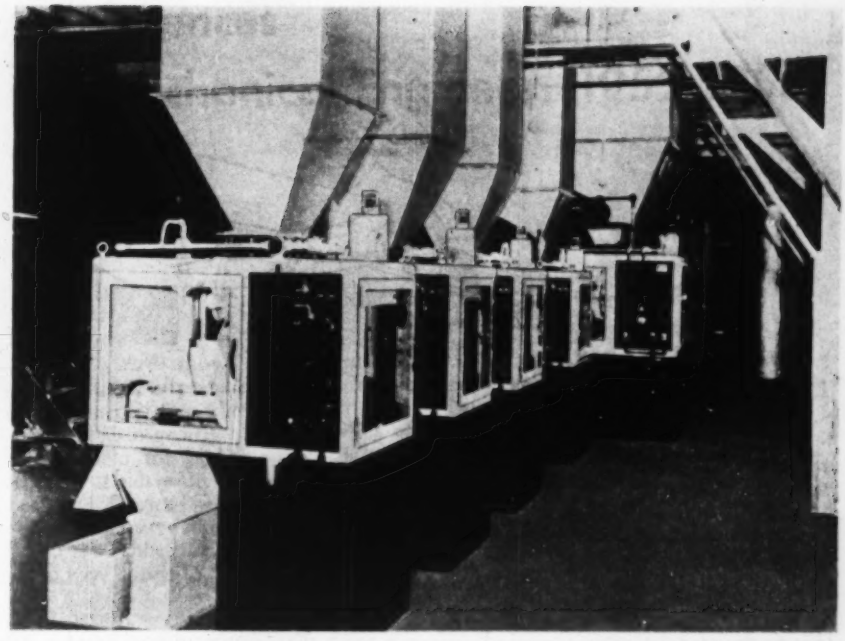

Fig. 9 Belt-type gravimetrics in feed mill for continuous compounding of fertilizer mixtures

In operation, a weight applied to the load-cell platform, supported by the diaphragm, operates the air pilot valve to maintain the exact diaphragm pressure required to balance the weight. In this way a direct reading of weight is obtained in terms of air pressure which in turn can be translated directly into a control or integrating function. When applied properly it will perform well in places where knife-edges and lever systems would require frequent maintenance. Typical examples of such applications are in dynamometer installations where vibration would soon reduce the sensitivity of scales employing knife-edges; and also in conveyer scales where roller vibration, belt joints, and dust accumulation tend to reduce sensitivity.

Fig. 11 shows the weighing section of a belt conveyer with load cell in the foreground. The weighing section (which may have one or more sets of idlers) is hinged at one end on dusttight antifriction bearings and at the outboard end is connected through even-balance lever arms to support the free end of the section weighing the return belt.

The section of the conveyer at which the weigh span is installed and for some distance beyond in either direction must be aligned with precision and must be checked to make sure that it does not shift as it carries the load.

The accuracy obtainable on a scale of this type is within $\pm 1/2$ per cent of actual weight passing over the scale from maximum to $1/2$ of rated capacity; within ± 1 per cent of actual weight from $1/2$ to $1/4$ per cent of rated capacity; and within ± 2 per cent of actual weight from $1/4$ to $1/10$ of rated capacity.

Fig. 12 presents a method for obtaining a preset constant weight rate of feed for a primary ingredient with automatic weight-rate adjustment of a belt-type gravimetric feeder. The conveyer scale controls the speed of the bucket elevator which loads the constant-speed main belt with the main component. In addition the conveyer scale also controls the belt speed of the gravimetric feeder at the right which handles an additive. This type of control is used where the end product must go through a cooling or drying process or where the quantity of material is limited by the capacity of the secondary equipment.

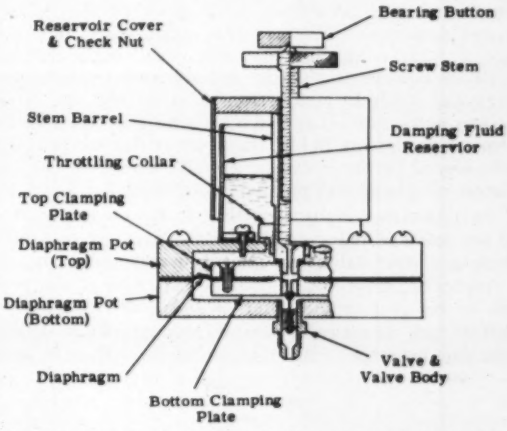

Fig. 10 Pneumatic load cell for use on belt feeders

Electronic Load Cells

No paper on the subject of continuous gravimetric proportioning systems would be complete without reference to the electronic load cell. This is manufactured either as a tension or compression element and consists of a high-strength steel column to the sides of which are bonded a wafer-thin matrix of bakelite-impregnated paper carrying fine wires arranged in a definite pattern.

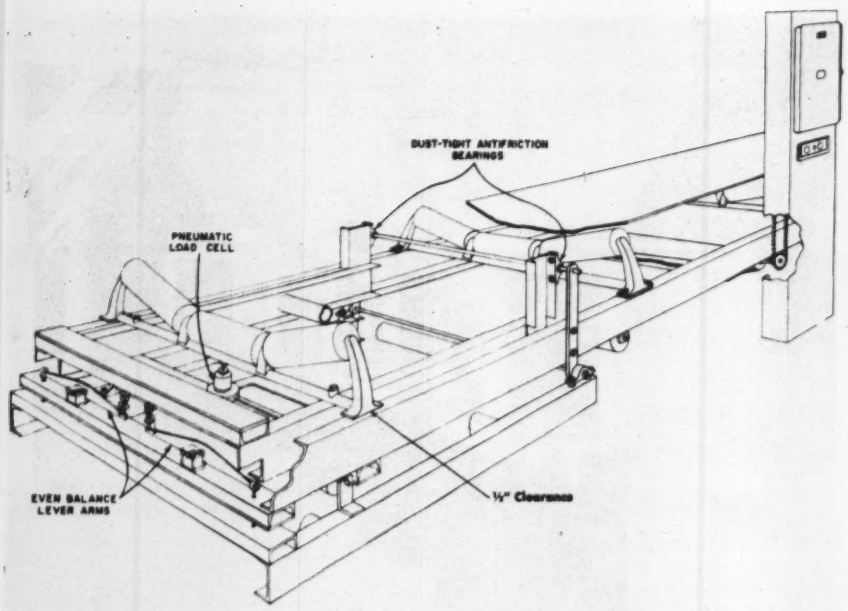

Fig. 11 Conveyer scale with pneumatic load cell

This fine-wire gage is thus strained uniformly with the steel column, and the resultant change in resistance of the wire as measured by appropriate electronic pickup instruments may be translated in terms of weight or a control function. Whereas the strain gage has been applied widely to dynamometer load measurements, thrust measurements, static and dynamic weighing of forces and loads in connection with testing and stress-analysis work as well as batch weighing in the food and chemical processing fields, there are still some problems to be solved before it can be applied widely in the continuous weighing-and-proportioning field.

The importance of direct weight measurement, without the necessity of reducing the forces involved to a point where a counterbalancing means of reasonable size can be employed, must not be overlooked. One of the problems to be overcome is that of zero "drift" which in itself is not insuperable when frequent check calibrations can be made. Another problem is that in many outlying installations it is difficult to find maintenance personnel capable of servicing electronic equipment.

Conclusion

It must be remembered that the counterbalance scale with its lever-multiplication system has met the test of time from Pompeiian civilization to the ultimate weighing accuracy demanded from it by the Bureau of Weights and Measures. Its simplicity, ruggedness, and inherent accuracy qualify it for use with most continuous gravimetric proportioning systems.

The development of materials, designs, and techniques doubtless will permit the newer electronic and pneumatic weighing systems to contribute materially to the art of continuous gravimetric proportioning. However, these devices as yet cannot match the precision of the counterbalance scale and therefore are recommended only where their small size or some other feature is more important than maximum accuracy.

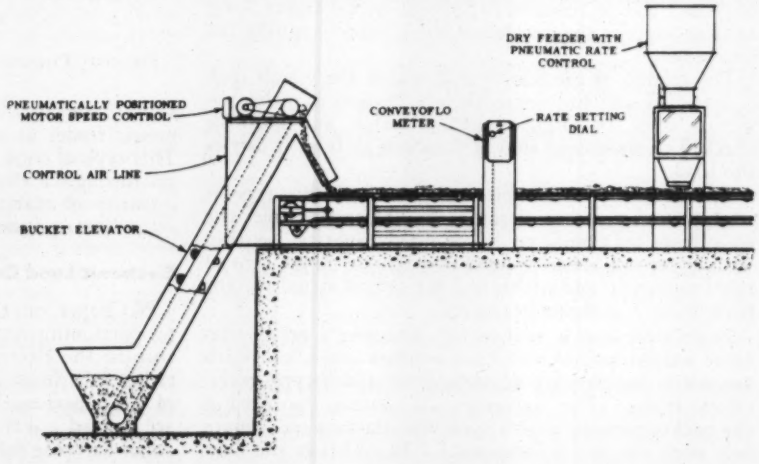

Fig. 12 Conveyer scale controlling feed for a bucket elevator as well as secondary feed from belt-type gravimetric feeder

Selected Plastic References for the Mechanical Engineer—1952-1953

By P. O. Powers, F. W. Elliott, J. K. Stevenson, K. E. Jackson, and J. R. Kelly

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THE literature of 1952-1953 (224, 227, 228)[1] shows a continued interest in the engineering aspects of plastics. Perhaps the greatest activity has been in the glass-fiber-reinforced laminates which are being used in greatly increased amounts in the automotive field for bodies. However, this is only one of many fields—aircraft, floor coverings, coatings, rubber, and fabrics—where plastics are being adopted. The plastics industry showed continued growth in 1953 (5, 7) and the rubberlike materials closely related to plastics also were active (6, 19).

Materials

There have been few new materials announced in the year under consideration, triallyl cyanurate (2) a new monomer for cross-linking resinous materials. Chlorosulfonated polyethylene (14, 15) has attracted considerable interest since it can be cured and possesses excellent resistance to ozone. A plastic material Vulcollan, developed in Germany, a polyester cross-linked with isocyanates (8) was studied in this country and found to give outstanding wear in tires.

New materials were developed in many fields (10). In most cases these were improvements over well-known materials, including coatings (9), plastics for aircraft (13), adhesives (3), and thermosetting resins (4). Polyethylene was the subject of at least one symposium (12), and new developments in phenol, urea, and melamine-formaldehyde resins (11) were considered. The poly alpha-chloracrylates (16) have been described and a platable phenolic has been offered (1).

A new book was published (17) describing vinyl resins and is an excellent survey covering the whole field of vinyl resins, including polystyrene, polyethylene, and the acrylates, in addition to vinyl-chloride resins, which the plastics industry often refers to as vinyl resins.

This field of vinyl-chloride polymers and copolymers has been active, and the plastisols have been described (18) as have plasticizers for these resins (21) and stabilizers (23). The migration of plasticizers has been studied (20), also the use of metal soaps as gelling agents (22) and the effect of heat and light (24).

Plastics containing fluorine (25, 28), notable for their resistance to heat and to solvents, have been developed further during the year. Fluorothene has been used in quenched film (29) and in wire insulation (30).

Teflon also has been developed for wire and cable insulation (31), for coatings and parts (26). Kel-F is suggested for coatings and gaskets (27).

Properties of Plastics

A study of the physical properties of plastics and particularly of reinforced plastics has indicated at best these materials approach metals in their weight-to-strength ratio (45), and it appears possible that a much greater strength can be achieved. The place of plastics in the order of matter has been considered (32). Properties of plastic materials have been described in many articles (34, 38, 39, 40, 42, 64, 68, 73).

Description of corrosion and solvent resistance is included in several cases. Plastics as materials of construction have been reviewed (48, 70). Testing has been the subject of several papers, as the interpretation of tests (63), test methods for plastics (54, 55, 66), and errors in testing (52). The relation between melt viscosity and tensile strength has been established (50). Impact strength (51), tensile impact (56), and shock resistance (62) of plastics have been studied, as has damping capacity (61).

Frictional characteristics of plastics have been described (43, 47) as has been the crazing of acrylates (46). Other studies include residual stresses, stress relaxation of insulators (49), flow through dies (72), and the change of resilience with temperature (76). Diffusion of water has been reported (60), also the effect of moisture of insulators (78).

Studies of properties of various materials reported include nylon (37), alkyd moldings (53), epoxy compounds (59), polyethylene terephthalate (57), flame-resistant polyethylene (58), and polyethylene (35). Other studies include properties of polyesters at 500 F (33), high-impact polystyrene (41), foams (65), finishes for glass fibers (75), and rheology of teflon (71).

Synthetic fibers (44, 77) have received considerable attention in this year and should warrant the attention of the engineers as new materials with unusual properties (225) for their possible use in laminates.

Fabrication

Design of molds and other equipment for shaping plastics has been given considerable attention (85, 101, 102, 104) as has the design of the parts themselves (82, 83, 85). Plastic machinery (119) has had an active year. Injection molding has been the subject of numerous articles (122, 123, 124, 125, 126, 128, 129, 130, 132, 133, 134) which discuss design, equipment, and operation. Dies from plaster forms (105), the box-type mold (103), and sprayed-metal molds (107) have been described. Ex-

[1] Numbers in parentheses refer to the Bibliography at the end of the paper.

Contributed by the Rubber and Plastics Division and presented at the Annual Meeting, New York, N. Y., November 29–December 4, 1953, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

trusion has been described in its various phases in many places (110, 112, 113, 114, 115, 116, 120, 121).

Welding of polyethylene and polyvinyl chloride (84) and of thermpolastics (97) has been studied. Heating of plastics (87) and use of high frequency (88) for heating have been reported. Glasscloth molding (90) and the honeycomb structures (86) are described, also catalyst spraying (96). Vacuum-forming (94, 95, 100, 106) has become increasingly popular as a method of forming plastic parts. Transfer-molding (93), cold casting (91), and the closed-mold technique (92) have been of interest, as has been plastic patching of steel pipes (108).

Studies of methods of fabricating materials include polyester pipe (80), polyethylene bottles (98), and carboys (81). Plastic pipe has found increasing markets where corrosion resistance and light weight are essential. Repairs for laminates (109) have been described. Extrusion of polyethylene (117) and polyvinyl chloride (118) has been studied. Molding of electrical accessories (89) is reported. Polystyrene has been used widely in injection-molding (122, 131); annealing of polystyrene moldings has been described (99). Sintered nylon (79) has been produced, and the extrusion of nylon has been studied. (111)

Application

Applications of plastics in engineering (154, 167) have become so varied and general that they are now found in the most unexpected places. Pipe for liquids and for gases has been produced from several plastic materials (156, 166, 171, 176, 178) although polyethylene has received the greatest emphasis. Foams from plastic materials (140, 157, 162) have found application in insulation, and as battery separators (161).

Plastics are used in motors (163, 165, 170), and machine parts (160, 175) are often plastic; nylon (139, 177) has been used for bearings and gears, and for terminal boards (137).

Polystyrene filaments and bristles (141) have been described. Many plastic materials are used in adhesives (149, 151, 164, 172, 173, 223) and the recently developed epoxy compounds have created widespread interest. Plastics have found application in tools (153) and are considered (155) as rocket propellants.

Aircraft is a field where plastics have been studied extensively (135, 150, 158, 168, 179) for the many uses they have found. Plastic-laminate boats (169) have been studied. During this year the plastic auto body has been reported at length (142, 143, 146, 159, 174), also laminates for truck panels (148).

Other uses for plastics include binders for foundry cores (145) in the chemical plant (144), in the plating industry (136), for battery cases (147), and as saturant for beater saturated gaskets (138).

Laminates and Reinforced Plastics

This field has been particularly active (185, 197, 205) and several new materials (190) have been offered. Interest continues in postformed (183) laminates and in wood laminates (182). However, the greatest emphasis by far has been on glass-fiber laminates (184, 192, 193, 194, 195, 198, 199, 200, 201, 203). One paper is concerned with the choice of fiber or cloth (202). Silicones have been considered in laminates (186, 191) and as size for the glass fiber (196). Polyesters have been described (187) as resins for laminating, as have phenolics (180) and other thermosetting resins (181). Low-pressure laminating methods have been outlined (188, 189).

Coatings

The wide field of plastics has been reviewed recently (226). Coatings for improved corrosion resistance have been offered (207, 217) and for eliminating electrostatic charges (209). Hot-spray lacquers are of continued interest (218, 221). Wet-blasting of molds (212) and wet-strength laminates (208) have been studied.

There has been considerable activity in coating of plastics (206), particularly by vacuum metallizing (211, 216, 222) and by photo-decoration (210). Coating of vinyl films (220) and fabrics (213) has been detailed. Marine paints (215) and the wash primer (219) are other items of interest. Epoxy resins (226) continue to be studied in the coating field.

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Briefing the Record

Abstracts and Comments Based on Current Periodicals and Events

J. J. Jaklitsch, Jr., Associate Editor

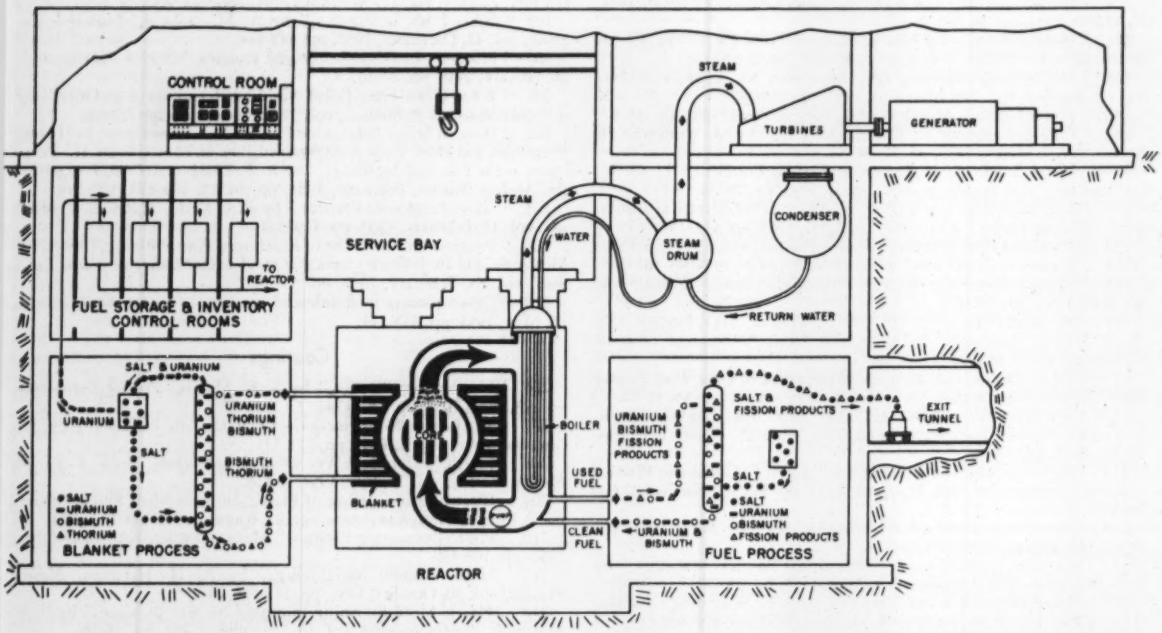


Fig. 1 Artist's conception of liquid-metal-fuel reactor—a design approach to a nuclear power reactor in which bismuth-uranium fuel would connect various processing systems. Heat from splitting of uranium 233 atoms in the core, *center*, would produce electric power, *upper right*. Simultaneously, neutrons originating in the core would breed additional uranium fuel by bombarding thorium atoms in the blanket, *center*. Fission products would be removed continuously, *lower left* and *right*, by extraction in melted salts. Another step, transfer of core heat to sodium to water, is not shown.

Liquid-Metal-Fuel Reactor

PRELIMINARY design details of a nuclear-reactor system which could generate electric power, "breed" new fuel for itself, and deliver by-products to waste tanks, all in continuous processes, were described by Clarke Williams, chairman, and Francis T. Miles, project scientist, of the Brookhaven Nuclear Engineering Department, Brookhaven National Laboratory, Upton, L. I., N. Y. They spoke before the International Congress on Nuclear Energy held recently at the University of Michigan in Ann Arbor, under the auspices of the Nuclear Engineering Division of the American Institute of Chemical Engineers.

Plan for Use of Liquid Bismuth as "Conveyer"

The system, known as LMFR (Liquid-Metal-Fuel Reactor), would provide the first usage of a liquid-metal alloy, in this case uranium-bismuth, as the fuel stream to interconnect continuous processes. The uranium used would be of atomic weight 233, a variety, or isotope, capable of splitting, or fissioning, as does the more commonly known U235.

Fission of the U233 atoms would occur in the LMFR core, a perforated graphite sphere 5 ft in diam. In the process, atom fragments called neutrons would fly out, splitting other atoms, releasing more neutrons, and thus maintaining a chain reaction. The chain reaction would depend upon the amount of U233 fuel present, and the shape and size of the graphite which moderates neutrons to speeds most favorable for fission.

Considerable heat would be given off in the fission process and would be promptly conveyed by the molten uranium-bismuth alloy out of the core. To keep alloy inventory low, this substance would transfer its heat to liquid sodium outside the reactor proper. As in other schemes for utilizing nuclear power, the sodium would deliver the heat to water, producing steam to spin a turbine which would drive a generator of electricity.

Perhaps the most important feature of the LMFR design is the integration of continuous chemical processing with the reactor. When a heavy atom like U233 fissions, each fragment, approximately half of the uranium atom, is a newly created element of intermediate weight. Some of these new products of fission appear as gases. Therefore, in one LMFR process, part of the

molten uranium-bismuth would be piped off for removal of such gases as xenon and iodine, by "sweeping" them out of the liquid metal with an inert gas such as helium.

In another process, liquid salts such as potassium and lithium chloride could be mixed continuously with the bismuth carrier. The salts would draw off fission products while leaving the uranium in the bismuth. While gaseous and liquid fission products are piped into storage tanks, uranium-bearing bismuth would be pumped back through the core to continue the production of heat.

Continuous Processing of Blanket Materials

Surrounding the LMFR core would be a graphite structure through which flows a mixture of thorium and bismuth. This arrangement is called a "blanket." The excess neutrons from the fissioning U233 atoms in the core would be captured by the thorium in the surrounding blanket and form more U233. LMFR is therefore a "breeder" which would replace the fuel as it is destroyed. The new U233 produced in the blanket would be continuously removed by an extraction with molten salt. This new U233 would go to a storage tank. From there it would be fed back through the core when needed, and the excess U233 would be available for shipment to other reactors. The thorium-bismuth stream would be pumped back through the blanket. The slight amount of fission products formed in the blanket would be removed by treatment similar to that used in fuel processing.

Low Costs, High Efficiency Cited

Several advantages which LMFR design offers as a source of power are as follows: Bismuth is impervious to radiation damage and transfers heat efficiently. As a result, enough fuel could be introduced into the core to provide a chain reaction which would produce large amounts of heat. Thus, with proper economy, excess neutrons would be available for capture in the blanket. Here, because of continuous recycling of thorium, all of it could be bred into U233, providing fuel at low cost. Continuous processing out of fission products would provide important cost reductions over present reactor-operation methods, which involve shipments of such products to special processing plants.

The stored fission products could be used as sources of radiation, in experiments on the use of radiation in sterilization, inducement of chemical reactions, and other phases of industrial operations.

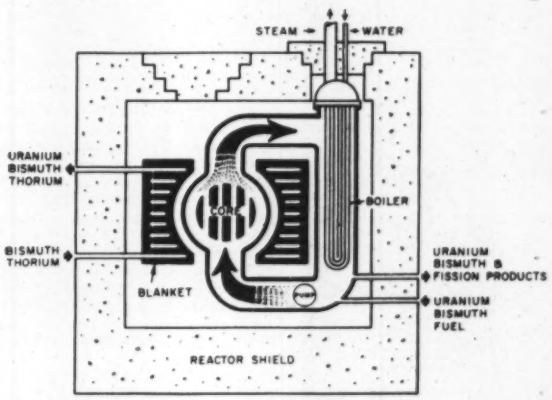


Fig. 2 Sketch of core of liquid-metal-fuel reactor. In this preliminary design, such a system could generate electric power, "breed" new fuel for itself, and pump liquid streams to other areas for processing—all on a continuous basis.

Low-Temperature Research

RESEARCH at temperatures near absolute zero (—460 F) is beginning to pay off industrially, according to the *Industrial Bulletin* of Arthur D. Little, Inc., May, 1954.

For example, helium is used in the refrigerated storage of liquid air, oxygen, nitrogen, and hydrogen, at temperatures down to —420 F. These "gases" are now available as liquids in high purity and large quantities, at low cost. Oxygen can be both liquefied and transported or stored for extended periods, as might be required for submarine or rocket use, without measurable loss through evaporation, using liquid helium as a refrigerant. One installation now in operation consists of a hydrogen liquefier with a capacity of 18 liters of liquid hydrogen per hour, and a built-in storage capacity of 800 liters. The liquid hydrogen is kept at atmospheric pressure with a helium refrigerating system. Another installation liquefies 50 lb of gaseous oxygen per hour, and is used to reduce boil-off losses in a large liquid-oxygen storage plant, used as the source for high-pressure oxygen for acetylene cutting, or replenishing breathing-oxygen supplies.

It is more economical to ship and store such gases as oxygen, argon, nitrogen, and helium in the liquid phase, from the point of view of saving both space and weight. Lighter containers may be employed because of the lower pressures involved. Special advantages in purity of product also accrue from the generation of these gases from the liquid phase. The gases are essentially free of water, and helium gas generated from its liquid is free of all contaminants since liquid helium is at the bottom of the temperature scale.

Upgrading Natural Gas

Ultra-low temperatures are also being considered for upgrading natural gas. Much of the gas now used is contaminated with nitrogen and other noncombustible gases as it comes from the well. By liquefying the bulk of the stream, the nitrogen could be vented off as a gas, leaving a larger proportion of combustibles to be carried in the pipe line at the same cost, or possibly transported in bulk as a liquid.

Similarly, hydrogen, which is increasingly important to industry, could be recovered from gas streams coming from the catalytic cracking or re-forming operations of the petroleum-refining industry. Because hydrogen has a lower boiling point than the other components, separation could be accomplished by low-temperature condensation of all components except hydrogen.

Electronics Industry Uses

The electronics industry is already familiar with the use of refrigerated traps for vacuum work. Vapors may be pumped faster by exposing them to a cold surface than by a mechanical or diffusion pump. At liquid-helium temperatures, all substances except helium itself

are solids, with completely negligible vapor pressures. A liquid-helium cold trap may therefore serve as a vacuum pump for all gases except helium. Fast pumping for processing delicate materials might be handled with this technique.

Another interesting use of helium refrigeration is in cooling sensitive electronic equipment to cut down random "noise" due to thermal agitation. Moreover, since pure helium does not become radioactive, it is especially useful as a coolant for processes carried out under conditions where strong radioactivity is encountered.

House of Weather Magic

A BROADENED research program looking as far ahead as 10 years into the future is now being mapped by The Trane Company with the dedication recently of its new Research and Testing Laboratory at LaCrosse, Wis.—a "House of Weather Magic" that triples the company's experimental and product-development facilities.

Intensive studies already outlined range from basic flow studies on varying types of coils to correlation of factors affecting condensing and evaporating coefficients of refrigerants, and from coil performance under severe frosting conditions to their performance at extremely high temperatures—and a host of other projects. It also appears likely that the laboratory will figure significantly in helping harness the atom for peacetime power.

Pursuing such studies, the laboratory tests radar tube coolers, for example, under conditions they might face in some arctic plane-spotting station. A section of the cold room in the laboratory is capable of creating —65 F temperatures. A long-range program designed to lick problems of frost formation on cooling coils is also under way. How different kinds and depths of frost coverings affect cooling-coil heat-transfer efficiency is being studied.

Quiet Room Floats on Felt

In a room-within-a-room that floats on felt and rubber, sound-sensitive instruments are used to measure noise in Trane equipment. In this quiet room—isolated from extraneous noise—sound meters, vibration probes, and octave band and harmonic analyzers are used to probe and diagnose for noise. Unit ventilators, compressors, and self-contained air-conditioning units are some of the products that are tested here in the development stage to make sure that their noise output will not raise the average sound level of the occupied area.

Fig. 3 Air-flow measurements are taken by technician from an air-tunnel test setup of an air-to-air brazed-aluminum heat exchanger in the air-tunnel room of the new Research and Testing Laboratory of the Trane Company, LaCrosse, Wis. The heat exchanger under test is not shown for security reasons.

Instrument-Calibration Room

In an instrument-calibration room, laboratory instruments are carefully checked at frequent intervals to insure the accuracy of performance and capacity rating tests of

Fig. 4 Preparing to test a new coil design in an air tunnel in the new Trane Laboratory, a technician adjusts the thermocouples. As many as 90 different temperature readings are taken in a single test on this 18-in. × 120 in. coil—one every few inches across the face of the coil surface. In addition, the bellmouth entrance of the air tunnel is designed to give uniform velocity to the air entering the coil test section.

Trane products. Instruments are calibrated for accuracy with precision laboratory master standards of pressure and temperature. For example, a high-precision water manometer, accurate to 0.001 in. of water, is used to check inclined manometers that help test and rate Trane fans.

Room-Within-a-Room

All four outer walls of the room-within-a-room are surrounded by chilled air to test and rate Trane convectors inside according to the strict Convector Rating Code.

These tests insure reliable capacity ratings from which convectors can be sized accurately. Walls of the inner room are maintained at 55 F. They could be made even colder for special tests—or even heated for testing air-conditioning units, by circulating warmed instead of refrigerated air around the outer walls. A 16-point indicating and recording thermometer outside the two test rooms makes a permanent record of the temperature picked up by thermocouples spotted inside the test room.

Compressors on Life Test

Hermetic centrifugal CenTraVac compressors are tested and rated in a specially designed area with facilities for controlling condenser-water temperature and cooling load. CenTraVac compressors from 200 to 300 hp currently are being operated to obtain performance data for unusual conditions not presently catalogued. An economizer for these compressors has been developed that is said to reduce power consumption 4.5 per cent.

Fig. 5 Under test in this air tunnel is a Trane brazed aluminum coil (light area within bellmouth air intake) which may cool the lubrication or transmission oil in any one of several heavy armored tanks. These brazed aluminum coils are, essentially, a stack of layers—each layer consisting of corrugated sheets between flat plates to form individual passages for the flow of fluids. Each passage is sealed with formed aluminum channels. These coils are said to have more cooling capacity than conventional coils twice their size and weight.

In another type of test, an 8-cyl reciprocating compressor was kept operating for a total of 8001 hr. At the end of this period the compressor was operating satisfactorily in every respect, and a detailed examination of all parts showed that they were in condition to be reassembled for further operation.

Other Testing Equipment

Reciprocating refrigeration compressors and condensers are tested in an unusual calorimeter. As an electrically heated evaporator boils the refrigerant, the electrical energy consumed is measured by a photoelectric cell that counts the revolutions of a watt-hour meter. The flow and temperature drop of the refrigerant, condensing water, and the electrical energy consumed by the compressor motor is also measured.

Steam coils are rated in an air-tunnel test setup which includes a grid of 60 thermocouples, spaced only 6 in. apart, on the leaving air side of the coil, and another bank of 30 thermocouples on the entering air side.

The large number of thermocouples are required in order to get a truly representative average of the temperature across the coil. In a similar test, each thermocouple is read individually to determine the uniformity of temperature distribution across the coil. In this rating test, the air and steam-pressure drops are measured and condensate is weighed. Where required, a preconditioning coil is used ahead of the coil under test to give a higher or lower air temperature into the test coil than the room temperature.

Temperatures ranging up to 2500 F can be created in an atmosphere-controlled furnace for research in new methods of fabricating heat exchangers designed especially to cope with the ever-climbing temperatures of new industrial processes.

The laboratory is equipped with chemical and metallurgical facilities for analysis of metals, oils, and refrigerants and for taking photomicrographs of metal specimens. An automatic salt-spray bath is used to test the relative corrosion resistance of metals and metal coatings.

250-Ton Spar-Skin Mill

A COMBINATION spar-and-skin milling machine, said to be the world's largest, has begun operation at the El Segundo, Calif., Division of Douglas Aircraft Company, Inc.

The intricate mill, weighing 250 tons, can machine entire sections of an airplane from thick aluminum plate 40 ft long × 10 ft wide, it was disclosed.

Designated G&L Hypro 100, the new tool was built to Douglas specifications by the Giddings and Lewis Machine Tool Company of Fond du Lac, Wis.

Two men operate the machine which is 90 ft long × 30 ft wide × 26 ft high and is sensitive to tolerances of 0.0015 in.

A look into the future, it was pointed out, indicates that increasing performance of jet combat airplanes requires that their wings and tails must be thinner, and yet stronger. To obtain this a trend is developing toward fabricating large self-reinforced sections rather than by piecing hundreds of riveted parts.

For example, in the milling of a typical wing section

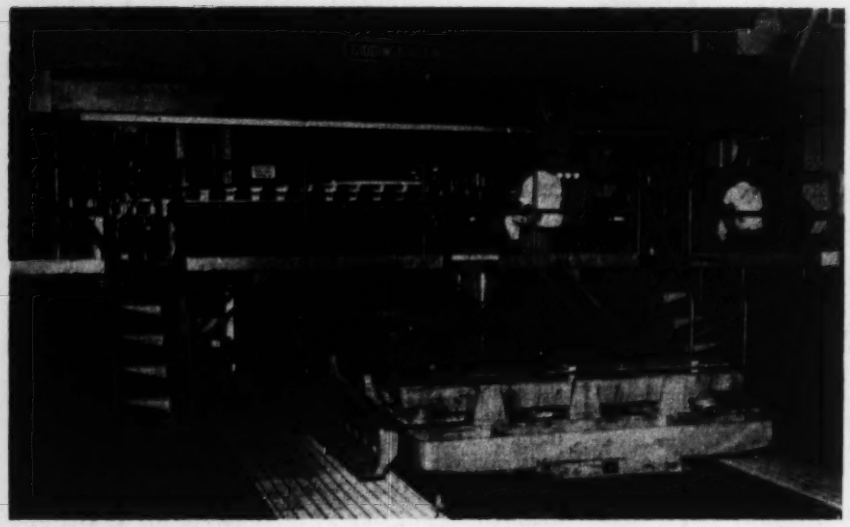


Fig. 6 Operators of spar-and-skin mill are able to straddle the machine's 40-ft worktable through use of a portable bridge which also serves as an ideal vantage point, placing them directly over cutter positions

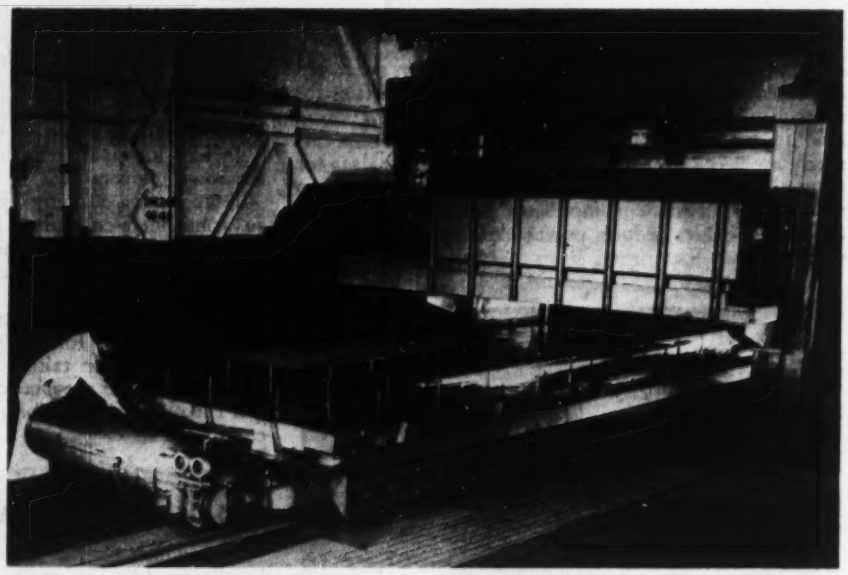


Fig. 7 The 10 × 40-ft worktable of the spar-and-skin mill is dotted with vacuum chucks which help hold parts in place and pneumatic lifters which aid in removing large finish-machined parts from the table. A feature of the 250-ton mill is its completely welded table which is made up in two 20-ft sections, including integral ribbing, table top, and supports.

from a piece of 2-in. plate, 8 ft long × 4 ft wide, parts were slashed from 29 to one, and 1300 rivets were eliminated.

The new double-duty mill is only one of a series of machines being acquired by Douglas El Segundo under the Naval Industrial Reserve Aircraft Program begun over two years ago.

It is claimed that the versatile new machine can carve out hundreds of parts into numerous self-strengthened shapes and finish them sooner than by conventional methods.

It is now in use fabricating sections of the Navy's world-record-setting F4D Skyray jet interceptor and new A3D Skywarrior twin-jet bomber, according to the announcement.

An outstanding feature is one of the machine's three Onsrud cutting heads which is automatically guided by a template or pattern. The pattern directs the cutter's carbide teeth through the milling of an intricate airframe section at speeds as high as 7200 rpm.

Work is placed on a 40-ft welded steel table which moves on rails at a speed of 150 ipm, beneath a portable catwalk which straddles it like a bridge. Two operators manipulate the General-Electric push-button control boards on the portable bridge or catwalk.

The spar-and-skin mill uses 12 drive motors totaling approximately 350 hp, exclusive of 18 motors and generators delivering the power supply. A 20-hp motor drives the worktable and smaller motors move the cutting heads on their guide rails.

Metal chips routed out by the three cutting heads are carried away at a rate of 900 cu in. per min by the cutting fluid gushing along either side of the moving worktable.

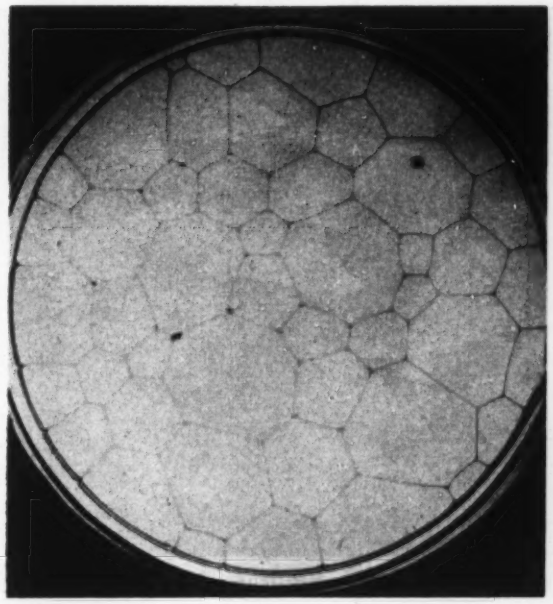


Fig. 8 View of a bubble cell shows how growth of bubbles is very similar to growth of metallic grains in metal. These bubble studies help metallurgists understand the process.

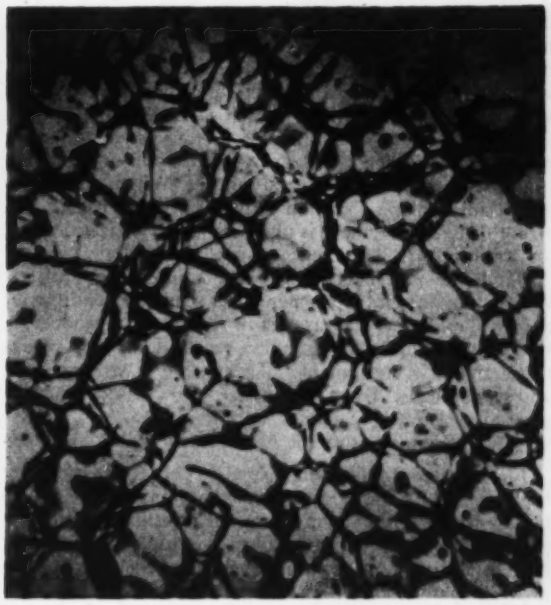


Fig. 9 Magnified view of the inside of an alloy of aluminum and tin, taken with an x-ray microscope, shows how the grains in a metal bear a striking resemblance to soap bubbles.

Bubble Study of Metal Grains

SOAP-BUBBLE studies in the General Electric Research Laboratory in Schenectady, N. Y., may aid in the development of metals that are stronger than those now in use and that have other improved properties.

According to Dr. Robert L. Fullman, research associate in the Laboratory's Metallurgy Research Department, the soap bubbles resemble in many respects the crystals or grains of which all metals are made. In particular, he has found, the way that little bubbles grow into big ones is closely analogous to the growth of metallic grains.

Neither the bubbles nor the grains ever grow by the coalescence of two smaller units into a larger one, he said. Instead, when a bubble or grain gets bigger, its boundaries expand at the expense of adjacent ones which contract and finally disappear.

Dr. Fullman's bubbles are not blown in the open air, but in special glass cells about 5 in. in diam and $^1/_2$ in. thick. Each cell is half-filled with a special soap solution. Then the air is pumped out of the cell and the space above the liquid becomes filled mainly with water vapor. The tube to the vacuum pump is sealed off so the exhausted cell may be handled.

When the cell is shaken vigorously and then laid on a flat surface, thousands of tiny bubbles appear above the liquid. After it has been allowed to stand for about 10 or 15 min the bubbles are larger and fewer. At this stage their continued growth may easily be observed. Dr. Fullman has also made lapse-time motion pictures which show the movements speeded up considerably.

The bubbles have varying numbers of sides, but when there are only three sides on a bubble it starts to disappear. The three sides shrink, while the vapor inside migrates through the walls into adjacent bubbles which are enlarged accordingly.

Dr. Fullman says that in a single metal grain the atoms are lined up like blocks in a wall. So are the atoms in a grain next door, but the rows in one grain do not line up with those in the other. The line of discontinuity is the boundary between the grains.

When a metal is heated, some of the grains enlarge, while others shrink and disappear, just as in the soap bubbles, he said. As the boundary of a grain passes an atom, the atom shifts its position a little to get into line with the rows in the expanding crystal.

Many metallurgical applications, such as the steel used in electrical transformers, depend on accurate knowledge and control of metal grains, Dr. Fullman pointed out. Hence studies of their behavior, by the bubble technique and other means, is expected to lead to new knowledge which may greatly improve the performance of metallic structures, he said.

Investment Spending

INVESTMENT spending has a long-run stimulating effect on employment and growth that consumer spending does not have, according to a recent National Association of Manufacturers' study entitled, "Tax Reduction as a Stimulus to Employment and Economic Growth."

The study defined consumer spending as people's purchases of food, clothing, housing, and all the other things used in our daily lives. Investment spending, it said, includes purchases of industrial machinery and building, tools, and similar things used in the productive process.

Tax reduction has its stimulating effect on the economy, if any, through its influence on people's decisions to buy things that otherwise they would not buy, said the study.

The study explained that people have to be employed to produce industrial equipment just as they have to be employed to produce consumer goods. If consumers de-

cide to buy an additional billion dollars' worth of automobiles, the report noted, about the same number of people will be put to work making the automobiles as would be put to work if manufacturers decided to buy an additional billion dollars' worth of factory machinery.

But investment spending has a long-run stimulating effect on employment and growth that consumer spending does not have, the study said. When consumers spend an additional billion dollars on automobiles, the stimulus to employment is over and done with when the automobiles are delivered.

But when investors buy an additional billion dollars' worth of plant and equipment, the plant and equipment are available thereafter as part of the nation's productive facilities. People can be put to work in the new plants using the new equipment. The nation is strengthened and standards of living can be raised as a result of our increased productive capacity.

Major conclusions of the NAM study follow:

1 Additional spending of any character—whether for consumer goods or for industrial plant and equipment—has a stimulating effect on production and employment. However, spending for plant and equipment has, in addition, a long-run beneficial effect on economic growth that consumer spending does not have.

2 Any form of tax reduction releases funds for increased spending either by consumers or by business. A reduction of the tax burden on investment income has a further effect on spending through improving the expected profitability of investment outlays.

3 Savings to taxpayers resulting from tax cuts may in some instances remain unspent and therefore have no effect in stimulating production. This is not likely to occur in the case of a tax saving to investors, since investors prefer to keep their resources in forms which can earn a return.

4 Under present circumstances there is every reason to expect that investment spending can be maintained or increased. What happens will depend in part on the anticipated profitability of investment—as affected by trends in the tax structure.

5 In recent years incomes from investments have not kept pace with the growth in consumer incomes, in general. Any form of tax reduction which denies relief to investment incomes would intensify the distortion.

The study pointed out that dividend payments have lagged behind the increase in other forms of income. In the 1930's dividend payments amounted to six per cent of national income, whereas in 1953 they were only three per cent.

Grinding Glass

Man has come to treat glass much like metal in his working of it, according to the spring issue of the Perkin-Elmer Instrument News. Almost without exception, the machines which are used today to grind and shape glass are metalworking machines—Blanchard grinders, Bridgeport milling machines, and similar machines which have been modified slightly to fit the characteristics of another medium.

In the place of high-speed tool bits, diamond-impregnated bronze grinding wheels are used. Under a sintering process, powdered bronze and diamond dust are pressure-fused into cutting heads which can saw or grind glass with ease.

Figs. 10–13 Four important steps in grinding glass include:

As in metalworking, a mineral seal oil or water-soluble oil flows over both cutter and work, acting as a coolant and keeping the surface free.

Selecting Glass

As metal stock is chosen according to the tempering and annealing it has undergone, its thermal characteristics, and resistance to corrosion, etc., so glass is selected for these qualities and other more important ones such as absorption, index of refraction, and dispersion. Pyrex, by virtue of its low coefficient of expansion, and plate glass, because of its low cost, are suited for surface-reflecting mirrors.

More expensive optical glass is chosen (1) for its index of refraction or light-bending power, and (2) for its dispersion, or power to break light into its colors. Crown and flint glasses are the most common here; crown with its low indexes and low dispersion, flint with high indexes and high dispersion. Also common are the barium crowns and flints which have higher indexes for a given dispersion. There are so many new glasses being manufactured that boundaries between crown and flint glass are no longer definite.

Once the optical properties are specified, the glass is ordered in a physical form as close as possible to that which it will assume when it is finished, yet allowing a substantial margin for grinding and polishing. It may be a sawed slab, a pressing (semimolten glass pressed into a form), a section of extruded glass, or blown glass.

Hand Grinding

The grinding department is little concerned with the niceties of a glass's index or dispersion or composition. It will shape any glass to the specifications it must meet befor it goes to polishing. Certain portions of the grinding today are still done by hand. The diamond-cutting machines can do the big jobs better, and they do much of the preliminary shaping, but after 15 years they have not begun to replace the hand processes for finishing.

Finishing (*top left*); Beveling (*top center*); Sawing (*top right*); Curve generating (*bottom right*).

Small or large pieces which are to become flats or prisms or lenses are first hand-ground on a spinning cast-iron mill wet with a slurry of carborundum to give them a flat surface. Then they are blocked in a form with wax and placed on the Blanchard grinder's table where they revolve slowly in a spray of coolant against the fast-spinning diamond-cutting head. They are reblocked as often as necessary until all desired surfaces and angles are attained.

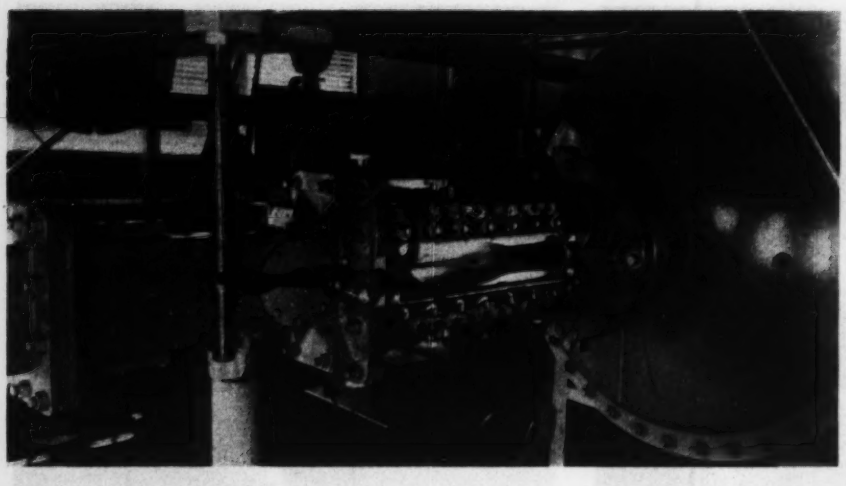
A larger piece of glass, such as a lens or mirror one foot in diameter, is fitted to the chuck or adaptor of a Perkin-Elmer modified Okey or Desenberg curve generator where one cutting wheel "edges" (or gives the glass the desired diameter) while another gives it the specified concavity or convexity. Fishbowl-like domes of blown glass are ground inside and out by specially designed dome generators developed by Perkin-Elmer. Smaller lenses are shaped on small, conventional curve generators.

Close Tolerances

In grinding, dimensions may be held to 0.001 in. lens radii to 0.002 in. prism angles to 1 min. Thickness is not a critical requirement in most optics. What is important is precise surface quality and accurate angles and radii. Here the analogy between metalworking and glassworking fails, for the precision of 0.0001 in., so important in fine metalworking, is only a rough mechanical dimension in the field of optics. Here surfaces must be figured to approximate the particular ideal geometrical form of sphere or plane, and dimension tolerances for certain finished (polished) lenses are as high as 1×10^{-7}".

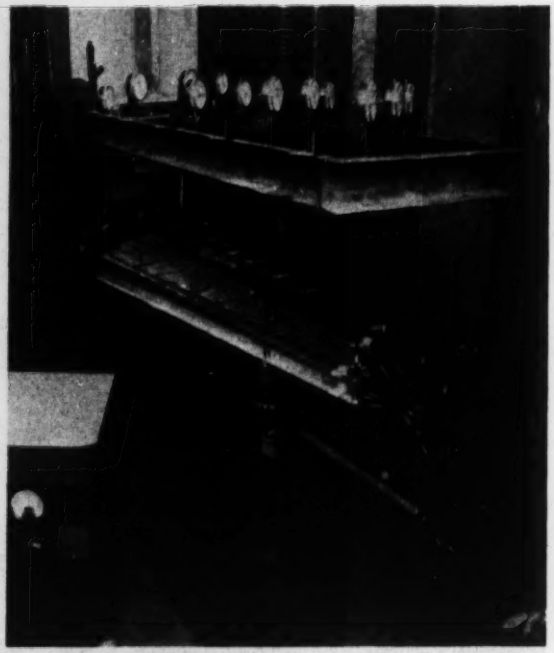
The final touches in many grinding operations both for curved and flat surfaces are applied by hand. Skilled workers rotate the pieces against revolving tools which resemble a potter's wheel, a mushroom, or a bowl. A fine slurry brings the tolerance within the range to permit polishing.

In some respects the workability of glass will never approach that of metal. Conversely, in achieving flatness, precise angles, and curves, metalworking falls short of glassworking.



Wind Tunnel. Test section of the supersonic wind tunnel at NBS. A hot-wire anemometer probe and supersonic blocks may be seen through the transparent window (*center*). Wind velocities of up to twice the speed of sound can be obtained.

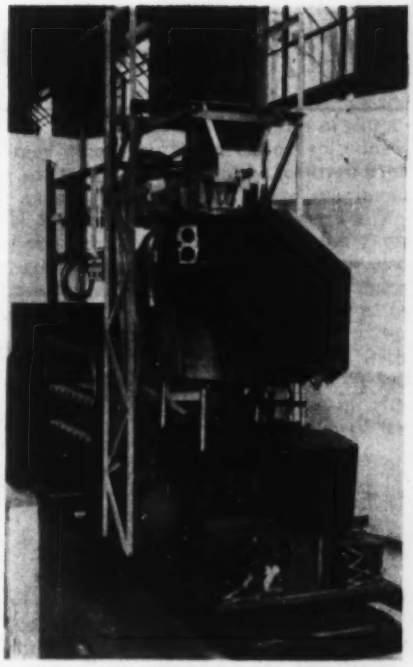
Aeronautical Research and Development at the National Bureau of Standards



Wing Load Studies. The stress distribution of a sweptback wing specimen under load is determined in a Bureau laboratory. The many wires lead from electric strain gages distributed about the specimen, and the dial gages measure the deformation. Studies of aircraft subassemblies and structures have been made to provide design information for applications where gust and maneuvering loads are unavoidable. NBS has developed theories for computing the stiffness of wings in flutter calculations and has made simulated landing-impact tests to check theories on the dynamic loads in aircraft during landing.

Airplane Design Theory. A dynamic model of a "four-engine airplane" is used at NBS to evaluate present design theory of large airplanes in regard to transient vibrations arising from landing impact. The model wing, consisting of a tapered box beam, was built to give a typical distribution of mass and flexural rigidity proportional to that of a well-known transport plane. The fuselage is equipped with a model alighting gear whose behavior can be changed over a wide range. The belting passing over the large wheels at the bottom simulates an airport runway moving with respect to the aircraft.

Ceramic Coatings. Ceramic specialists at the National Bureau of Standards apply an NBS high-temperature ceramic coating to a jet-engine combustion liner in preparation for a test in a J-48 engine. Here (*left*) the coating slip is sprayed on the outer surfaces of the liner.

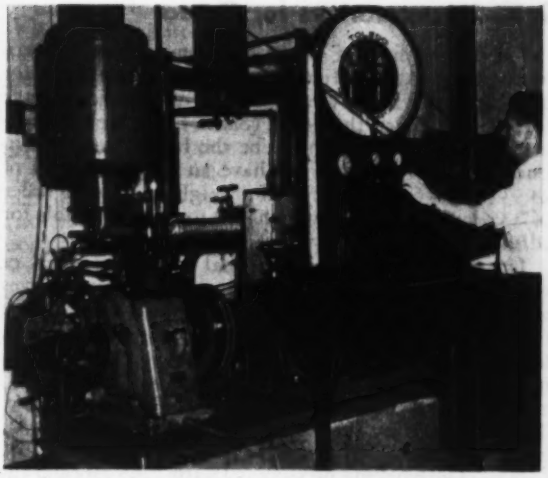


Kinorama. Prototype model of the kinorama (*right*) a device developed by NBS for evaluating airport-approach light systems. The pilot sits in the trainer cockpit and looks through the telescope at the miniature-approach light configuration which is moving toward him in the trough below. He controls the simulated path by means of the wheel (a small segment of which can be seen through the open door) and by the pedals (out of sight).

PROGRESS in aviation has become increasingly dependent upon research and development in the physical sciences and engineering. With the current emphasis on airborne defense, American industry and government are co-operating in an extremely broad nationwide program of scientific investigation and engineering adaptation directed toward the production of faster, safer, and more reliable aircraft.

As part of this effort, the National Bureau of Standards is working on a variety of individual aeronautical projects. Since the scope of the Bureau's functions is broad, NBS is frequently called upon to undertake specific research and development projects for the Department of Defense, the Civil Aeronautics Administration, the National Advisory Committee for Aeronautics, and other Government agencies interested in aviation. Examples are current studies of turbulence in supersonic wind tunnels for the NACA and of aircraft lighting for the Navy Bureau of Aeronautics. Also, as custodian of the national standards of physical measurement, NBS carries on research leading to improved methods of measurement and calibration which are often of value in aeronautic instrumentation. Thus work on pressure standards and humidity measurement has been applied to aeronautic barometers, altimeters, and hygrometers.

From time to time the Bureau's facilities for basic investigation into the properties of matter have been utilized to solve problems in aeronautical research. For example, when condensation of the constituents of air became a serious problem in the operation of hypersonic wind tunnels, the Bureau undertook research on heats of vaporization, phase behavior, and other properties of oxygen, nitrogen, and their mixtures. In addition, much of the information obtained in the Bureau's program on the properties of materials—especially plastics, metals, fuel components, and ceramics—is pertinent to aircraft design and has provided a basis for other studies on specific problems of the aircraft industry.



Fuel Studies. One of the single-cylinder variable-compression engines with which the Bureau compares the knock ratings of standard reference fuels. These reference fuels—normal heptane and iso-octane—are used throughout the country for the knock rating of aircraft and automotive gasolines. Also, a continuing program of combustion research, sponsored by the Navy Bureau of Aeronautics since the beginning of the last war, includes both basic and applied studies of burning velocities, flame temperatures, gas sampling and mixing, and the development of design and performance data on combustors for turbojets, ramjets, and afterburners. Another phase of the work being performed for the Bureau of Aeronautics is concerned with the development, evaluation, and improvement of test equipment for the components of aircraft fuel systems.

European Survey

Engineering Progress in the British Isles and Western Europe

J. Foster Petree,[1] Mem. ASME, *European Correspondent*

Fig. 1 Standard-gage locomotive with a 2-10-2 (Santa Fe) wheel arrangement completed for the State Railways of Greece

2-10-2 Locomotives for Greece

THE Italian firm of Breda Elettromeccanica e Locomotive S. p. A., of Milan, have recently completed for the State Railways of Greece a batch of 20 standard-gage locomotives, with the 2-10-2 (Santa Fe) wheel arrangement, which are thought to be the largest yet built in Europe. See Fig. 1. They have an over-all length of 24.93 meters (81 ft, 7 in.) and a weight in running order of 136 metric tons, of which 100 tons are available for adhesion.

The tender, with 12 tons of coal and 25 cu meters of water, weighs about 63 tons. Some of the locomotives are fired by hand and others by automatic stoker. The frame, of 38-mm plate, is riveted. The boiler has a length between tube plates of 6100 mm (20 ft) and a maximum internal diameter of 2264 mm (7 ft, 5½ in.) and contains 48 tubes of 137.5 mm bore and 158 of 54 mm. The total heating surface is 316 sq meters (3400 sq ft) and the surface of the superheater 128 sq meters (1380 sq ft). The working pressure is 18 atm (265 psi) and the steam is superheated to 400 C. The grate area is 5.6 sq meters (60 sq ft) and the volume of the firebox 11.5 cu meters (406 cu ft).

The two simple cylinders, driving on to the center pair of coupled wheels, are 660 mm (26 in.) bore, with a stroke of 750 mm (29½ in.), and are fitted with piston valves actuated by Walschaerts gear. A Beyer-Hadfield servomotor, which can be operated either with steam or compressed air, is fitted for reversing. The driving wheels are 1600 mm (5 ft, 3 in.) in diam and the tractive effort at 85 per cent boiler pressure is 31,400 kg (69,300 lb); on a level track a speed of 90 km per hr (56 mph) can be maintained with a 450-ton train. The wheels of the leading truck, which is of the Krauss-Helmholtz type, are 850 mm (2 ft, 9½ in.) in diam and those of the Bissel trailing truck 1050 mm (3 ft, 5⅛ in.). The tender is carried on two four-wheeled trucks, with wheels also of 1050 mm in diam. The twin Kylchap blast pipes are fitted with spark arresters. A Worthington pump takes the cold feedwater from the tender and discharges through the feed heater to a turbine pump which delivers it to the boiler. There is also a Friedmann injector. Braking is by compressed air, on the Knorr system. Compressed air is also used for sanding.

A full illustrated description of these locomotives, from which the above details were taken, was contributed to the April issue of *Ingegneria Ferroviaria* (Rome) by the designer, Dr. Ing. Giovanni Biressi.

Open-Hearth Flames and Output

THE West of Scotland Iron and Steel Institute is to hold a one-day conference on Open-Hearth Flames and Output on September 10 in the hall of the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank Crescent, Glasgow, C.2. It will open with a paper on "Combustion and Radiation Characteristics of Oil and Coke-Oven Gas Jet Flames," by Prof. M. W. Thring of Sheffield University, who, before taking up his present appointment last year, was closely concerned with the extensive experimental work on flame radiation conducted at Ijmuiden, Holland, by a team of British, Dutch, and French scientists. Other papers will be on "Melting Rates in the Open-Hearth Furnace," by E. J. Burton; "Improvements in Firing Oil and Coke-Oven Gas in the Open-Hearth Furnace," by J. A. Leys; "Making Producer Gas a Competitive Fuel," by Dr. G. W. C. Allan; and "The

[1] Correspondence with Mr. Petree should be addressed to 36 Mayfield Road, Sutton, Surrey, England.

Use of Various Fuels in the Open-Hearth," by W. B. Wright. Mr. Burton and Mr. Leys belong to the British Iron and Steel Research Association, Dr. Allan to the British Coal Utilization Research Association, and Mr. Wright to the Scottish steelmaking firm of Colvilles, Ltd. Applications to attend the conference should be received by the secretary, Mr. P. W. Thomas, at 39, Elmbank Crescent, Glasgow, not later than August 31.

Iron Founding in Great Britain

THE annual report of the Council of Ironfoundry Associations shows that in 1953 the industry produced 3,638,429 tons of castings, of which 3,504,181 tons were grey and high-duty iron and 134,248 tons were malleable iron. This was 3.2 per cent less than in 1952, but the returns for 1952 were for 53 weeks and those for 1953 only 52 weeks. The largest single category of castings comprised pipes and malleable tube fittings (683,338 tons). The next largest were building and domestic castings (548,529 tons), ingot molds (374,471 tons), railway equipment (328,638 tons), and automobile castings (271, 357 tons). The biggest percentage increase among these items was in ingot molds (18.3 per cent), reflecting the increase in crude-steel production from 16,418,000 tons in 1952 to 17,609,000 tons in 1953.

Stuffing-Boxless Centrifugal Pump

FOR handling liquids that are abrasive or corrosive, or which must not be mixed with sealing water, a vertical-spindle centrifugal pump with no stuffing box has been developed by the Jönköpings Mekaniska Werkstads A/B, of Jönköping, Sweden. See Fig. 2. It has been well tried out in chemical works and pulp mills in Sweden and, the results being satisfactory, is now being manufactured for export under the name of the "Nobox" pump. Mounted on the spindle above the impeller is a sleeve having at the upper end a smaller impeller, integral with it, rotating in a chamber filled with the sealing liquid—usually the liquid that is being pumped unless its nature is such that a separate sealing supply is necessary. Rotation of the sealing impeller forces the liquid outward in an annular ring so that it cannot leak into the pump casing while the pump is running. A flexible diaphragm above the sealing impeller prevents any ingress of air or upward leakage of the liquid. On the underside of the sealing impeller is a faced ring which, when the pump stops, acts as a valve to prevent leakage downward past the sleeve into the casing. The sealing chamber is surrounded by a jacket through which cooling water can be circulated.

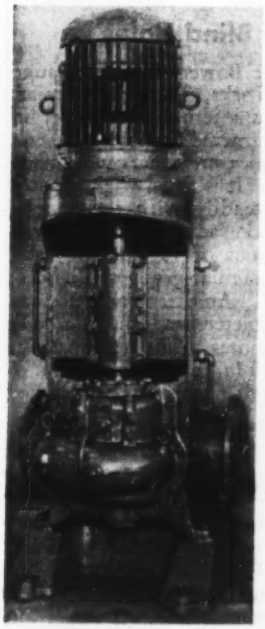


Fig. 2 "Nobox" stuffing-boxless centrifugal pump

The pumps are made in three forms, known as the Z30, Z32, and Z33 series. The Z30 is a series of single-suction single-stage pumps with the casing split horizontally so that the pump impeller can be removed from below without breaking pipe joints. The maximum capacity is 560 U. S. gpm to a head of 250 ft with a permissible range of pressure at the suction flange from 50 psi to a vacuum of 24 in. of mercury. The Z32 series are also single-stage, but with a double-suction impeller and a vertically split casing. They will pump 2600 gpm to 185 ft, with a suction pressure from 39 psi to 24 in. Hg. The Z33 series are two-stage single-suction pumps with vertically split casings, delivering up to 130 gpm at 500 ft head, with suction pressures from 55 psi to 24 in. Hg. The pumps can be supplied in hard lead if required for pumping acids.

Mobile Crane With 90-Ft Jib

THE most prominent exhibit at the Mechanical Handling Exhibition, held in London, England, June 9 to 19, was the Coles "Colossus" mobile crane, Fig. 3, shown by Steels Engineering Products, Ltd., of Sunderland. Fitted with a 30-ft jib of tubular lattice construction, it can lift 92,000 lb at a radius of 12 ft; but it can also be provided with a 90-ft jib to which can be attached an additional fly jib, giving a maximum height of lift of rather more than 100 ft. Its principal field is expected to be the erection of steel-framed buildings, oil-refining plants, and similar applications. The chassis is carried on eight pairs of wheels, all driven and all fitted with brakes operated by compressed air. The driving unit, which is detachable, is mounted on four single wheels. All the tires are of the same size, 14 in. × 24 in. Traveling power is provided by a Rover Meteorite 8-cyl diesel engine of 250 hp, with a tandem drive through double-reduction gears to each axle. The primary reduction is by a worm gear and the second reduction by two epicyclic gear trains. There are 12 forward speeds and three reverse speeds. Steering is power-assisted.

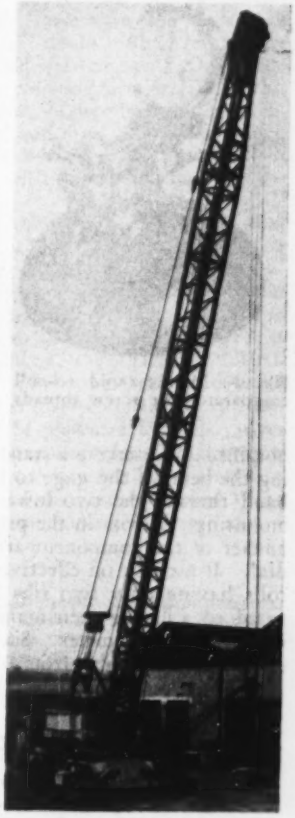


Fig. 3 Coles "Colossus" mobile crane shown with 90-ft jib

Power for the crane motions is obtained from a Perkins P6 diesel engine of 80 hp, driving a variable-voltage generator which supplies current to separate motors for hoisting, derricking, and the full-circle slewing motion. All the motors have electromechanical brakes which are applied automatically if the current is interrupted, either intentionally or not. Safety limit switches are fitted to the hoisting and derricking motions. Two 100-gal fuel tanks are carried on the chassis, each having its own fuel pump. The clearance height of the chassis is 16 ft, the tail radius 12 ft, and the wheel base 21 ft. The unladen weight is about 50 long tons.

Rapid Comparator for Screw Threads

THOUGH the Gauge and Tool Exhibition which was held in London, England, from May 17 to 28 was only the fourth of its kind to be organized by the Gauge and Tool Makers' Association, this event has already become one of the most important of the periodical British technical and scientific exhibitions. A notable feature in the series is the steady increase in the number of measuring instruments designed for factory use in the quantity production of components of high precision. Among these, at the recent exhibition, was the "Matrix" tri-roll thread comparator, Fig. 4, introduced by the Coventry Gauge and Tool Company, Ltd., of Coventry. It consists of a substantial cast-iron base on which are mounted three threaded rolls. By depressing the lever, the rolls are separated to allow the component to be inserted. It is then rotated between the rolls, any irregularity being transmitted through the top roll to the dial gage, which reads to 0.0001 in. and is fitted with tolerance pointers. The mounting carrying the rolls and the gage can be clamped at an angle to suit the operator's line of sight. Zero setting is obtained by inserting a standard setting plug and rotating the bezel of the gage to the zero reading. For left-hand threads the two lower rolls are reversed in the mounting. Errors in the pitch, angle, and effective diameter of the component are read cumulatively on the dial. If a check on effective diameter only is required, rolls having only two ribs are used. These are truncated to a flat on their major diameter and are cleared on the minor diameter. Six models are available, covering a range of sizes from 0.1 in. to 1.5 in. in diam.

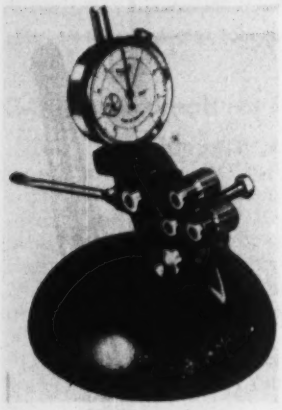


Fig. 4 Matrix rapid tri-roll comparator for screw threads

Twist-Drill Comparator

ANOTHER new instrument shown by the same firm was the "Matrix" optical twist-drill comparator, designed to take drills from $1/16$ in. to $1/4$ in. in diam, Fig. 5. Mounted on the cast-iron base are a projector, a housing for a 12-volt lamp, and a translucent screen. Between the light source and the screen is a V block in which the drills are placed. A shadow outline of the drill is projected on the screen, magnified five diameters, and can be compared with the designed angle of the drill point as indicated by lines engraved on the screen. A movable stop enables the shadow to be positioned accurately on the screen graticule. A fine-focus adjustment is provided by means of a knob on the side of the screen mounting. If the cutting point of the drill is off center, this also can be detected, as the engraved lines are accurately located with reference to the edge of the screen. The cast-iron base is formed hollow and contains a lighting transformer and fuses which are equally suitable for British and American voltages.

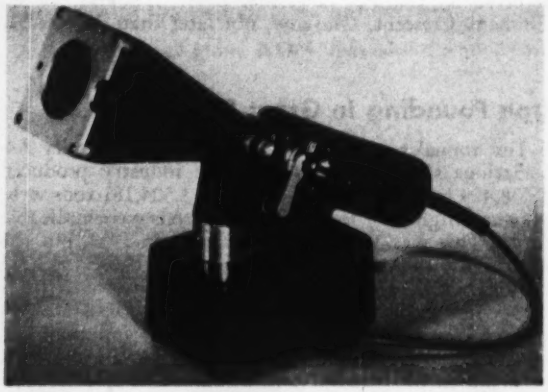


Fig. 5 Matrix optical twist-drill comparator—a new instrument designed to take drills from $1/16$ in. to $1/4$ in. in diam.

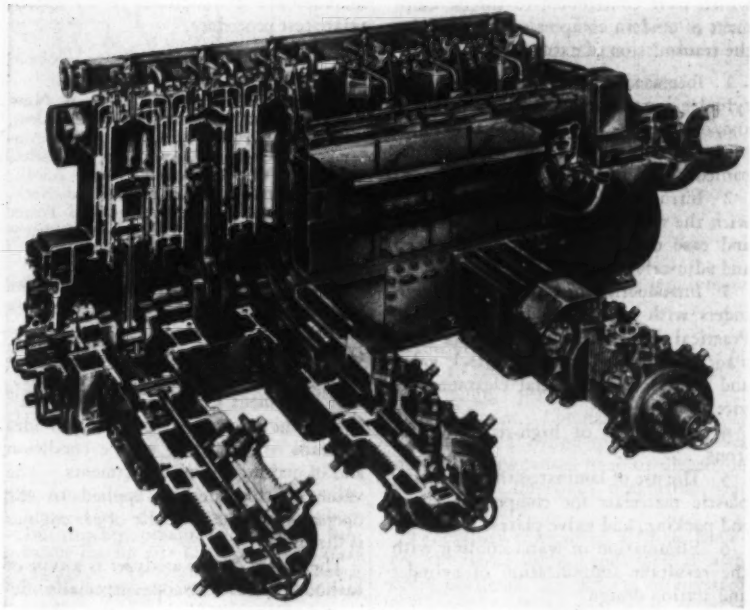
Internal Micrometer for Blind Holes

AT the same Exhibition, the Bowers Internal Gauge Company, Ltd., of Pioneer Works, Thornbury Street, Bradford, England, showed an internal micrometer in which the three anvils can be retracted flush with the end face of the instrument, so that measurements can be made to the bottom of a blind hole. It is fitted with a pistol grip so that it can be held steadily with the fingers, leaving the thumb free to make adjustments. Anvils can be supplied with projections of various sizes and shapes suitable for measuring angular grooves, V slides, screw threads, and taper bores. An extension piece can be inserted between the micrometer head and the body to take measurements in long bores. The instrument is made in three sizes, to measure 1 in. to $1\frac{1}{2}$ in., $1\frac{1}{2}$ in. to 2 in., and 2 in. to 3 in., but other sizes can be supplied to meet special requirements.

Emile Huchet Power Station: Correction

A PRINTER'S error occurred in the "European Survey" for April in the article on page 358, headed "Colliery Tailings Pumped to Boiler Plant." In the last line but one of that paragraph it was stated that the boilers at the Emile Huchet power station generate steam "at 1600 psi and 90 F." The steam temperature is actually 990 F.

Substance in Brief of Papers presented at ASME Meetings



Cutaway view of turbosupercharged two-cycle spark-ignited gas engine

Oil and Gas Power

Turbocharging Two-Stroke Gas Engines, by C. A. Chamberlain and G. H. Bollman, Clark Brothers Company, Olean, N. Y. 1954 ASME Oil and Gas Power Conference paper No. 54—OGP-7 (mimeographed; available to April 1, 1955).

With the rapid growth of the natural-gas industry, the use of the gas engine, particularly the two-cycle, has become more intensive. Hence it is natural that the benefits of turbosupercharging should be directed toward the two-cycle, spark-ignited gas engine. The paper presents details of a new type of turbosupercharged two-cycle gas engine.

The basic change in the design is the adoption of the enbloc type of construction with the removable power-cylinder liners in place of the individual cylinders which characterized previous engines. This has provided not only greater structural strength and rigidity but has made possible several features which contribute to the improved performance of the engine.

Perhaps most significant among these is the streamlining of the air and exhaust passages at the points of high velocity approaching and leaving the ports of the cylinder liners. This is essential for maintaining a low pressure drop from blower discharge to turbine inlet.

This construction also has made possible the location of the scavenging-air intercoolers just upstream of the cylinder ports—an individual cooling section for each cylinder. This location prevents any possibility of the air picking up heat from the engine parts after being cooled. The coolers also act as flame arresters, preventing the ignition of any fuel which might have penetrated into the induction system of the engine during a shutdown.

In general, bearing sizes have been increased considerably. In the 14 in. × 14 in. turbocharged engine, for example, main bearing area has been increased 22 per cent, crankpin bearing area 9 per cent, power-piston wrist-pin area 20 per cent, and compressor-cylinder crosshead-bushing area by 150 per cent.

The introduction of the turbocharged compressor with its attendant savings in fuel, cooling duty, and over-all installation cost will undoubtedly prove to be an important contribution to the gas-transmission industry and others concerned with the procurement and distribution of natural gas.

A Summary Report of Projects Dealing With the Deterioration of Cooling-Tower Lumber, by D. R. Baker, The Marley Company, Kansas City, Mo. 1954 ASME Oil and Gas Power Conference paper No. 54—OGP-4 (mimeographed; available to April 1, 1955).

The deterioration of cooling-tower lumber may be caused by chemical attack or decay. A number of research projects have been undertaken to determine the effect on the wood of various chemicals commonly present in the circulating water. The results of these projects are summarized and compared. One of the problems encountered in projects of this type is that of selecting analytical methods to be used in evaluating the results. This problem is discussed and the various methods that have been used are described.

The research projects indicate that sodium carbonate or bicarbonate are about the only chemicals commonly present that cause serious chemical attack. Indications are that much of the deterioration attributed to chemical attack is actually due to decay organisms. Chemical attack lowers the durability of wood and renders it susceptible to decay. Decay may be prevented by preservatives that can be applied before or after a tower is erected. A new method of treatment is described that can be applied to an existing cooling tower after erection.

Foundations for Pipe-Line Compressors, by C. E. Holvenstot and S. G. Hagerman, Assoc. Mem. ASME, Ingersoll Rand Company, Painted Post, N. Y. 1954 ASME Oil and Gas Power Conference paper No. 54—OGP-5 (mimeographed; available to April 1, 1955).

At the Oil and Gas Power Conference in Baltimore, Md., June, 1950, a paper was presented on the "Principles of Foundation Design for Engines and Compressors," which brought out a new concept

of designing foundations to avoid resonance. This principle is now generally accepted and is widely used in the compressor industry.

Since this paper was presented, further studies and tests have been made verifying the original concept that the natural frequency of a foundation must be high to have good stability.

This paper reviews the concept of the elasticity of the ground and emphasizes the importance of designing foundations to avoid resonance. The origin of inertia forces which occur in all reciprocating machines is discussed. These forces excite vibrations and tend to produce resonance in foundations when their frequency is near the natural frequency of the foundations. The phenomenon of resonance in foundations is explained and clarified. This paper shows how resonance can be avoided and sets forth practical rules for foundation design.

Trends in Gas Transmission-Compressor Cylinder Design at Cooper-Bessemer, by W. Hartwick, The Cooper-Bessemer Corporation, Mount Vernon, Ohio. 1954 ASME Oil and Gas Power Conference paper No. 54—OGP-1 (mimeographed; available to April 1, 1955).

Efforts of Cooper-Bessemer to keep abreast of the changing requirements for gas transmission-compressor cylinders have resulted in design improvements and the introduction of new features which ultimately produced cylinders intended primarily for gas-transmission service. This paper reviews the progress and explains the principles of specialized features adopted. Considerable attention is given to factors which have motivated the improvements and innovations covered.

The following items comprise the major improvements and innovations which have contributed to the development of modern compressor cylinders for the transmission of natural gas:

1 Increased valve areas in consecutive cylinder designs through the use of more and/or larger valves. Increased gas-passage areas and nozzle sizes accompanied these improvements in valving.

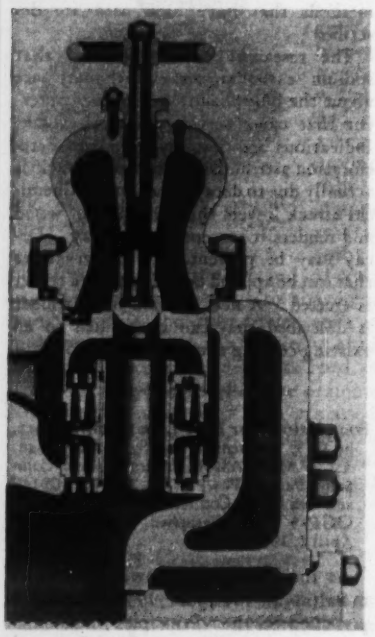
2 Introduction of double-deck valves with the resultant increase in valve area and ease of providing additional fixed and adjustable clearance.

3 Introduction of high-clearance cylinders with their attendant flexibility. Practical high-clearance cylinders were made possible by the double-deck valve and its associated special clearance devices.

4 Utilization of high-strength cast irons.

5 The use of laminated thermosetting plastic materials for compressor rings, rod packing, and valve plates.

6 Elimination of water cooling with the resultant simplification of cylinder and station design.



Double-deck suction valve equipped with manually operated valve-cap unloader

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Presenting the New AIEE-ASME Speed-Governing Specifications for Internal-Combustion Engine-Generator Units, by W. L. H. Doyle, Mem. ASME, Caterpillar Tractor Company, Peoria, Ill. 1954 ASME Oil and Gas Power Conference paper No. 54—OGP-6 (mimeographed; available to April 1, 1955).

This paper reviews limitations found in speed-governing specifications currently employed in connection with purchases of engine-generator units. The extensive use of the ambiguous terms found in these specifications points to the great need for a uniform terminology applying to engine-speed control. Frequently some of the performances specified are unattainable. Costly disagreements often result from differences in interpretations of current specification clauses because of the terminology and the differences in procedures that may be used for evaluating actual performances.

To meet these conditions the Joint AIEE-ASME Subcommittee, after several years of deliberations, now introduces a uniform terminology together with three separate standard purchase-type speed-governing specifications. The terminology and the specifications are expressed in terms of measurable performances which can be determined under reproducible operating conditions either at the time of final acceptance or at other times for purposes of development.

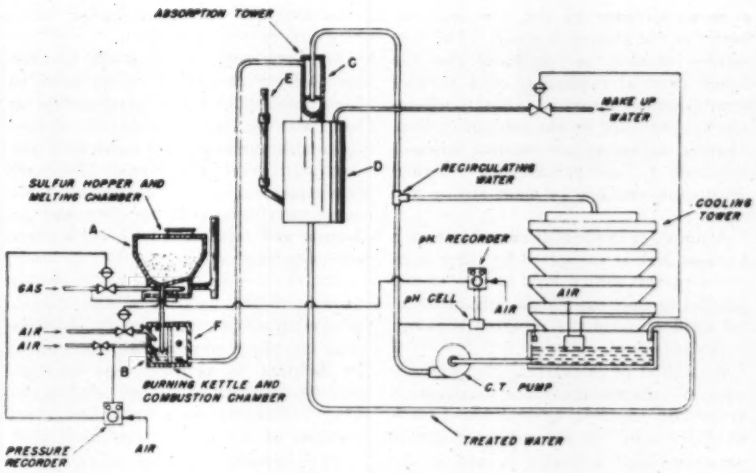
The paper also discusses a proposed industry-wide co-operative program to expedite the early general usage of these new speed-governing standards. This includes the development of an appropriate test procedure.

The Sperry Engine Analyzer—A New Method of Gas-Engine Supervision, by J. E. Hart, Mem. ASME, Kaiser Aluminum & Chemical Corporation, Chalmette, La., and E. A. Sammis, Mem. ASME, Sperry Gyroscope Company, Great Neck, N. Y. 1954 ASME Oil and Gas Power Conference paper No. 54—OGP-2 (mimeographed; available to April 1, 1955).

For many years it has been the practice to balance cylinder output of gas engines on the basis of firing pressure. A new technique of balancing to the detonation limit offers several operating advantages. The equipment used to accomplish balance to the detonation limit also provides a means of indicating engine condition and of making engine adjustments. The value of this method applied to the operation and maintenance of gas engines is discussed.

The Sperry engine analyzer is a type of cathode-ray oscilloscope especially designed to operate with engines. It provides a reference scale so that engine events can be observed in terms of crankshaft degrees while the engine is operating. Either the full engine cycle or a small portion of the engine cycle can be observed. A knob is used to select the crankshaft position at which the scale starts, so the engine event observed can be identified clearly as to cylinder and crank angle. A timing reference signal derived directly from the main shaft is provided so that timing can be measured to within 1 deg. By means of pickups attached to the engine the operating condition of the ignition system can be evaluated thoroughly, and impacts occurring within the engine, such as gas admission, valve closure, and detonation, can be observed and timed with respect to crankshaft position.

The Sperry engine analyzer provides a means of effecting a significant reduction in the cost of operating spark-fired gas engines by facilitating quick and accurate adjustment during operation. Also, by indicating the operating condition of the ignition system and of engine events which involve impacts, such as gas-admission-valve operation, the analyzer promises to make a significant contribu-



Schematic layout showing fully automatic cooling-water treating equipment

tion toward the goal of engine overhaul based on knowledge of operating condition rather than on the basis of engine time.

The Alleviation of Cooling-Water Problems—Use of Automatic Sulphur-Burning Equipment, by J. T. Russell, Panhandle Eastern Pipe Line Company, Kansas City, Mo. 1954 ASME Oil and Gas Power Conference paper No. 54—OGP-3 (mimeographed; available to April 1, 1955).

A FULLY automatic installation for treating cooling water is described. This requires only weekly tests for supervising treatment and has reduced costs of chemicals from 50 to 75 per cent below former treatments. Only two treating chemicals are used—sulphur and a corrosion inhibitor. Sulphur is burned in a specially designed burner, with the rate of burning regulated by a recording pH controller. The corrosion inhibitor serves also as an algaecide and bacteriacide, so that by the use of these two treating chemicals a means has been found of alleviating the most important cooling-water problems.

Aviation

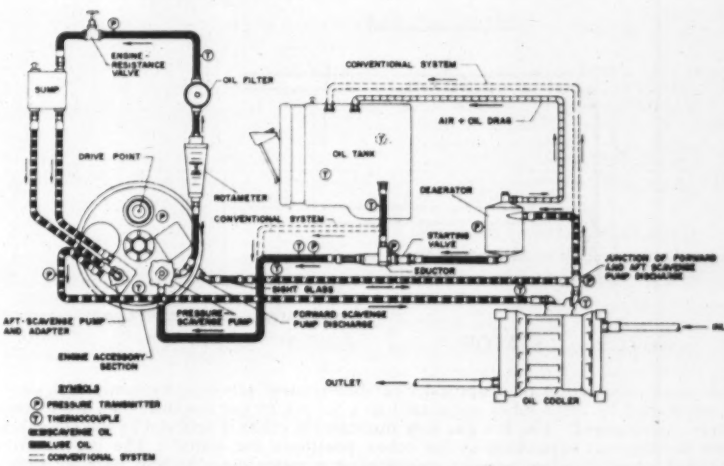
The Closed-Circuit Lubrication System Applied to a Turbojet Aircraft Engine, by R. G. Cunningham, Assoc. Mem. ASME, and P. H. Schweitzer, Mem. ASME, The Pennsylvania State University, State College, Pa. 1954 ASME Semi-Annual Meeting paper No. 54—SA-1 (mimeographed; available to April 1, 1955).

THE lubricating-oil system of a current-production turbojet engine was converted to the closed-circuit system. This circuit utilizes the output of the scavenge pump to pressurize the inlet to the pressure pump, permitting operation at high altitudes. Compared with earlier applications, the high-speed engine gears and oil pumps caused finer air dispersion in the oil. Improved deaeration was found necessary.

Laboratory tests in an altitude chamber simulated flight conditions at altitudes of 70,000 ft. Effects of inverted flight, rapid climbs and dives, priming starts of the deoiled system, cold-weather starting, and variable engine speed were investigated.

Essentially, sea-level performance was regularly obtained up to altitudes of 60,000 ft. Under some conditions reduced flow occurred at 70,000 ft. Low-altitude deaeration and high-altitude boost and flow were improved by use of an altitude-controlled deaerator vent. Concluding the laboratory development, one engine in a multiengine bomber was converted to the closed-circuit system.

The flight tests demonstrated that the modification could be effected on an airplane without making changes in the engine proper. Deaerator size was limited by space availability. At low altitudes incomplete deaeration resulted in below-normal flow rates. Priming in-flight starting, performance during climb, level flight, and dive were satisfactory.



Closed-circuit lubrication system applied to a current turbojet aircraft engine

Fuels

Important Considerations in the Use of the Wind Tunnel for Pollution Studies of Power Plants, by Gordon H. Strom, Mem. ASME, and James Halitsky, New York University, New York, N. Y. 1954 ASME Semi-Annual Meeting paper No. 54—SA-41 (mimeographed; available to April 1, 1955).

THE theoretical basis for wind-tunnel experiments on stack-gas pollution by power plants is examined and important variables and scale factors are presented. Test results are presented to show some effects of these variables. The test procedure now in use at the New York University $3^1/_2 \times 7$-ft wind tunnel is described. Correlation with limited field data is presented with a discussion on accuracy of wind-tunnel experiments.

The test section of the tunnel is 30 ft long, $3^1/_2$ ft high, and 7 ft wide. The plant model is located at the beginning of the test section, and for convenient observation of the smoke plume, one side of the entire test section is of plate glass. Wind speed is controlled by a

Ward-Leonard system applied to the fan motor at the discharge end of the tunnel. Wind speed is measured with a thermopile-type probe (Hastings air meter) over the model. For smoke generation air metered through a Flowrator is passed through a metal chamber into which oil vapor produced by electrically heated vaporizers is admitted. Smoke density is controlled by adjustment of the oil supply to the vaporizers. Helium also is metered through a Flowrator before addition to the smoke in the tube leading to the model. For detection of pollution at ground level, the phototube was installed at a scale distance of 3000 ft from the plant facing a light source across the tunnel, the beam being approximately 20 ft above ground.

When the air flow, helium flow, and smoke density are adjusted properly, the wind is set at a speed low enough so that the smoke plume is visibly off the ground. The light meter connected to the phototube is read. The wind speed is increased in small increments and the corresponding light-meter readings noted and plotted for determination of critical wind speed.

Gas Turbine Power

An Automatic Control for Close Clearances in Rotating Machinery, by Arthur Kantrowitz, Cornell University, Ithaca, N. Y. 1954 ASME Semi-Annual Meeting paper No. 54—SA-25 (mimeographed; available to April 1, 1955).

THIS paper presents a simple servomechanism to hold close clearances between stationary and rotating machine elements in the presence of thermal distortion. The clearance is "measured" as in an air gage by the flow from an outlet in the clearance space. The corrective motion is produced by the linear thermal expansion of a tubular strut (thermal actuator) whose temperature is controlled by the measuring flow. Thermal actuators can produce motions sufficient to compensate for thermal distortions and can be made strong and rigid.

A simple example is discussed in which a stator disk is supported by three thermal actuators which hold it close to and parallel with a rotor disk. Experimental verification of the expected behavior is presented.

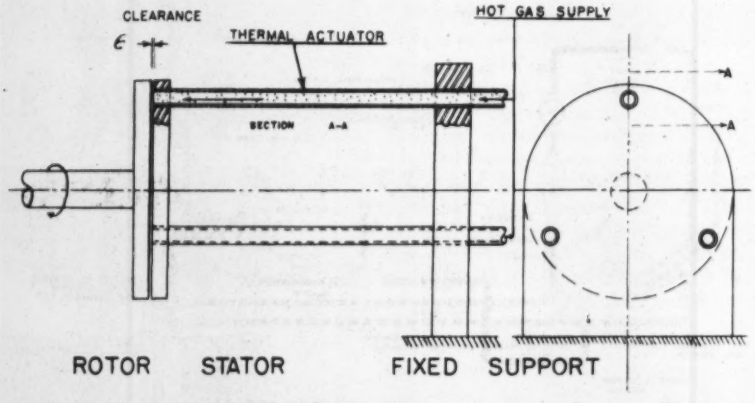
A method of calculating the performance of thermal-clearance controls is given and checked against the experimental results. A discussion of design variations and formulas to aid in the design of clearance controls to specifications is presented. Finally, a sample design with which clearances can be held to a few ten thousandths of an inch in the presence of 0.035 in. of distortion is presented.

The Combustion-Efficiency Problem of the Turbojet at High Altitude, by W. J. Olson, J. H. Childs, and E. R. Jonash, National Advisory Committee for Aeronautics, Lewis Flight Propulsion Laboratory, Cleveland, Ohio. 1954 ASME Semi-Annual Meeting paper No. 54—SA-24 (mimeographed; available to April 1, 1955).

THIS paper discusses NACA research on the single problem of combustion efficiency of turbojet engines at high altitudes. Representative results of investigations with turbojet combustors are presented to illustrate the trends obtained with the following categories of variables: (*a*) Combustor operating variables, (*b*) combustor-design variables, and (*c*) fuel variables.

The data indicate that as the environment of the combustor becomes one of low pressure and low temperature at high altitude, low combustion efficiencies and limited values of obtainable temperature rise are encountered. Increased cross-sectional area of combustor for a given weight flow of air decreased velocities and facilitated high combustion efficiency at altitude.

For the design of the liner, increased volume in the flame zone and gradual admission of the air into the combustion space were shown to aid combustion by helping to provide that localized fuel-air mixtures of correct composition exist sufficiently long for ignition and combustion to occur. For high combustion efficiency to occur, all of the fuel must be involved in this manner. It was shown that the combustor design, the fuel injection, and the fuel volatility must be matched if optimum combustion efficiency is to be achieved. Further, it was shown that, for a given combustor, fuel injector, and fuel volatility, fuels of higher flame speed and/or lower ignition temperatures gave higher combustion efficiency at high-altitude operating conditions.



Schematic illustration of proposed clearance-control servomechanism. The stator is supported by three tubes connected to a supply of gas considerably hotter than their environment. The hot-gas flow through the tubes is metered by the clearance, and the thermal expansion of the tubes positions the stator. The use of three thermal actuator tubes permits positioning a stator close to and parallel with a rotor since the clearance is controlled at three points.

Application of High-Speed Strain-Gage Torquemeter to Turbomachinery Research, by H. A. Buckner, Jr., and J. J. Rebeske, Jr., National Advisory Committee for Aeronautics, Lewis Flight Propulsion Laboratory, Cleveland, Ohio. 1954 ASME Semi-Annual Meeting paper No. 54—SA-23 (mimeographed; available to April 1, 1955).

IN turbomachinery-component research, it is frequently impractical to obtain power measurements by conventional cradled dynamometers. This paper presents a description of a high-speed strain-gage torquemeter and shows the application of this torquemeter to compressor and turbine setups. The paper also discusses pertinent factors for obtaining accurate measurements with the instrument.

In general, torque-measuring instruments may be classified under one of the following three types: Torque-reaction type, angular-twist type, and surface-strain type. The torque-reaction type requires the measurement of some external reaction force. The angular-twist type utilizes the principle of measuring the angular deflection in a gage length of shaft, the angular deflection being proportional to torque transmitted. The surface-strain type utilizes the principle that shaft torque and shaft-surface strain are proportional.

In the strain-gage torquemeter, the shaft-surface strain is measured by the use of suitably mounted bonded-wire strain gages, which are merely fine wires having the property of the resistance being very nearly a unique function of the strain applied. The readings are transmitted through slip rings to appropriate electronic equipment where shaft torque is read. The torquemeter consists of three basic components: The torsion shaft, the slip rings, and a self-balancing potentiometer.

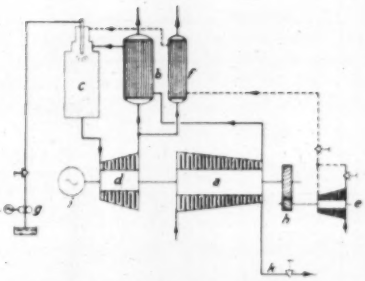
The strain-gage torquemeter has been applied successfully to high-speed turbomachinery research where a high degree of accuracy is required. Satisfactory life and accuracy have been obtained for rotational speeds up to 17,000 rpm. This maximum speed is not a limit but is as high as has been obtained in these installations.

The strain-gage torquemeter appears to have a wide range of applicability to high-speed equipment. It could be used, for instance, to measure compressor or turbine power in a turbojet or turbine-propeller engine, propeller power, and with different gage arrangements, propeller thrust in turbine-propeller engines, and to measure shaft power in many large stationary applications.

Operating Experiences With Gas-Turbine Plants in the Steel Industry—Comparison of the Gas Turbine With Other Prime Movers, by Hans Pfenninger, Brown-Boveri & Company, Ltd., Baden, Switzerland. 1954 ASME Semi-Annual Meeting paper No. **54—SA-21** (mimeographed; available to April 1, 1955).

THE gas turbine, the youngest of all thermal power plants, already has proved itself in practice. Many different plants are in operation, both in America and Europe. Of the European manufacturers, the firm Brown-Boveri (Switzerland) has had the most experience in this field. Apart from the sets for the Houdry process, the first of which was installed in 1936 and has over 100,000 hr to its credit, and also apart from over 100 gas turbine-compressor sets built for Velox boilers, Brown-Boveri has placed 14 gas-turbine sets in industrial operation. The paper describes briefly several Brown-Boveri gas-turbine installations and, in more detail, two sets at work in the steel industry.

A gas-turbine set from Brown-Boveri is installed in the Altos Hornos de Viscaya steel works. This machine is used solely to provide pressure air for the Bessemer converters. The gas-turbine output is controlled from the converter platform. A lamp system is used to signal the required output to the gas-turbine operator, who then adjusts the load on the machine from the control board.



Schematic diagram of Baracaldo steel works which is particularly interesting with its combined burner for blast-furnace gas and fuel oil. (*a*, air compressor; *b*, regenerator; *c*, combustion chamber; *d*, gas turbine; *e*, blast-furnace gas compressor; *f*, blast-furnace gas preheater; *g*, fuel-oil pump; *h*, gearing; *i*, starting motor; and *k*, air duct to steel works.)

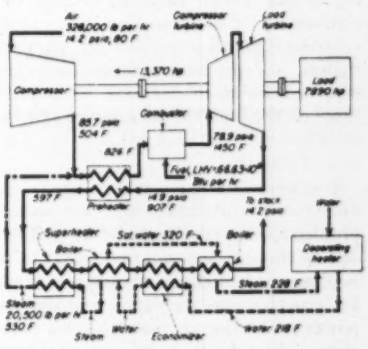
The set is fitted with pressure-oil governing and the required speed of the gas turbine is obtained by adjusting the sleeve of the centrifugal governor. A temperature control at the turbine inlet (Honeywell regulation system) limits the maximum air quantity that can be delivered to the converters in order to prevent too high temperatures at the turbine inlet.

The use of a combined burner for both oil and blast-furnace gas is of special interest. This is provided to keep the set in operation during shortages of blast-furnace gas. Such a shortage of gas would cause a drop in speed of the gas-turbine set and a corresponding decrease in the air pressure for the converters. This would be dangerous if the pressure should fall below the minimum necessary to prevent entry of molten iron into the blast nozzles. With the combined burner, fuel oil can be added immediately if there is insufficient blast-furnace gas. Experiments and actual works experience have shown that not only blast-furnace gas alone, but also mixtures of blast-furnace gas and oil, and even oil alone, can be burned successfully.

Gas-Turbine Process Using Added Steam, by Benjamin Miller, Ozone Park, N. Y. 1954 ASME Semi-Annual Meeting paper No. **54—SA-42** (mimeographed; available to April 1, 1955).

LOWER cost per horsepower for equipment and lower fuel consumption per horsepower-hour generated can be attained by adding steam to the air in the gas-turbine process. To obtain maximum benefits from steam addition requires equipment not yet commercially available, but substantial increases in both capability and thermal efficiency can be achieved by adding steam-generating equipment to gas-turbine power plants now being marketed as well as to some which already have been installed. Naturally, the water needed to generate the steam must be available at reasonable cost.

For example, a gas-turbine power plant rated 5700 hp at 25 per cent thermal efficiency can have its output increased to 7500 hp at 29 per cent thermal efficiency



Flow diagram, gas-turbine plant operating with steam-generating equipment

by the addition of steam-generating equipment costing considerably less than one fifth as much as the gas-turbine plant. The water requirement is less than 50 gpm.

This paper shows how such improvements in capability and economy can be realized through steam addition by describing the application of this feature to the General Electric one-compressor, two-turbine gas-turbine power plant.

Problems in Formulation of Design Procedures For Continuous-Flow Combustion of Hydrocarbons, by G. S. Bahn, Mem. ASME, and G. W. Koffer, Marquardt Aircraft Co., Van Nuys, Calif. 1954 ASME Semi-Annual Meeting paper No. **54—SA-22** (mimeographed; available to April 1, 1955).

THIS paper considers what is involved in establishment of design procedures for combustion of hydrocarbon fuels in continuous-flow processes. It is concerned primarily with power-plant applications where the combustion gases themselves do the useful work. Specifically, gas turbines, turbojets, afterburners, and ramjets are considered.

The primary problem in combustion is the matter of combustibility. You must have a fuel which will burn under the

conditions imposed. This raises the question of flammability limits. A mixture of fuel and air may be either too lean or too rich in fuel concentration for combustion as such to take place, regardless of all other considerations.

The next problem is that of ignition and flame stabilization. It has been established that flame velocities are very low, and artificial means (cans or gutter burners) must be used to establish a flame front in a high-velocity air stream. There must be some region of the combustor where the fuel can be ignited, either initially by some external means or, in the case of the steady state, by combustion of the preceding fuel. This criterion is the all-important one. Nevertheless, the practical combustion engineer is inclined to overlook its importance on the basis that if a design simply does not operate, it is not worthy of a second thought.

If you have a flammable mixture, ignited and stabilized, the remaining problems are ones of performance. How serious these are depends upon what is to be demanded of the combustion system. In general, the problems involved in power production are more complex than those where heating alone is the purpose of the combustion. However, it may require high-grade, expensive power (such as electricity) for efficient operation of the combustion system. In this case there may be a great advantage in an ability to extract such power from an installation of which the combustor is a part.

After consideration of ignition and flame stabilizaion as separate items, combustion-performance factors which may be of real importance, depending upon the application, are as follows: 1 Combustor size and configuration limitations; 2 Efficiency of combustion; 3 Uniformity of temperature profile developed; 4 Durability of combustor materials; and 5 Pressure drop through the combustion system.

Exhaust-Gas Sampling of a Small-Scale Combustor and Determination of Combustion Efficiency, by L. M. Whitney, Shell Development Company, Emeryville, Calif. 1954 ASME Semi-Annual Meeting paper No. 54—SA-61 (mimeographed; available to April 1, 1955).

THE need for a rapid continuous recording instrument for determining the combustion efficiency of gas-turbine engines led to a development of an exhaust gas-analysis instrument based on infrared absorption. The use of this instrument in developing reliable techniques and equipment for sampling are reviewed.

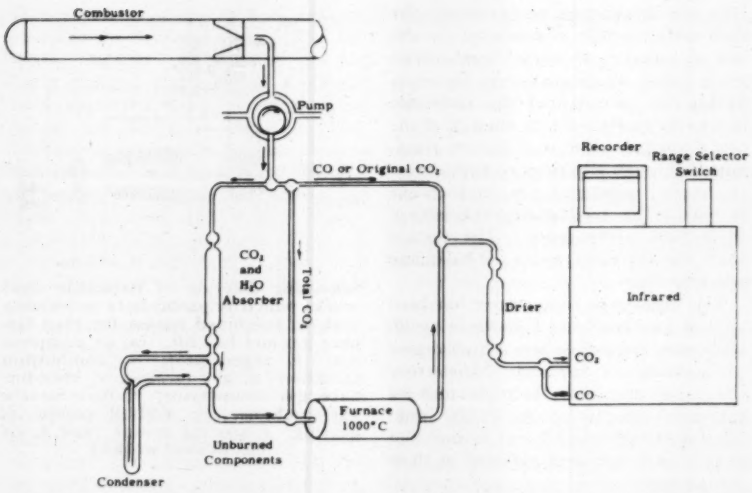


Diagram of exhaust gas-analysis instrument based on infrared absorption

By correlation with detailed, mass spectrometric analysis of the exhaust of a small-scale combustion tube, an accurate method of determining combustion efficiency by exhaust-gas analysis was developed. By many comparative analyses between the instrument and the mass spectrometer, a simplified method of obtaining a rapid continuous recording of combustion efficiency of a small-scale combustor was possible. The mathematical basis for this is briefly described.

Measurement of Total Emissivities of Gas-Turbine Combustor Materials, by S. Mario De Corso, Westinghouse Research Laboratories, East Pittsburgh, Pa., and R. L. Coit, Assoc. Mem. ASME, Westinghouse Electric Corp., Lester, Pa. 1954 ASME Semi-Annual Meeting paper No. 54—SA-26 (mimeographed; available to April 1, 1955).

A PROCEDURE and apparatus for measuring emissivities of strip material and ceramic coatings are presented. The method utilizes a thermopile which views the test specimen through an aperture in a controlled-temperature shield. The apparatus is calibrated periodically by means of a black body, which is described. The calibration of the thermopile arrangement showed that the ratio of the thermopile emf to the fourth power of the absolute temperature of the black body is a constant over the temperature range 800 to 2000 F. This enables you to take as the emissivity of a source simply the ratio of the thermopile emf, when viewing the source, to the black-body emf at the corresponding temperature.

Emissivity data are presented for sheet material in the as-rolled and sandblasted condition, for type 310 stainless steel, Inconel, Nichrome, and mild steel. In addition, data were obtained for several types of ceramic coatings on the same metals. Values of spectral emissivity versus wave length are shown for Inconel sheet as-rolled and a typical radiation-suppressing coating. The spectral emissivity increases with decreasing wave length for the Inconel while the opposite is true for the ceramic coating A417-235.

The data presented show that combustor wall temperatures can be reduced by sandblasting of the external surfaces and application of a suitable ceramic coating on the internal suraces. If a black-body flame at 3500 F is assumed inside the combustor, ceramic coating of the inside of an Inconel combustor will reduce the radiant heat transfer to the combustor wall by nearly one third.

Installation and Operating Experience With a Naval Gas-Turbine-Powered Landing Craft, by J. O. White and J. S. Pasman, Assoc. Mem. ASME, U. S. Naval Engineering Experiment Station, Annapolis, Md. 1954 ASME Semi-Annual Meeting paper No. 54—SA-43 (mimeographed; available to April 1, 1955).

SINCE 1951 the Navy has been testing a 160-hp, 220-lb gas turbine in a standard landing-craft hull. This paper describes the three configurations developed in two boat hulls. Installation problems and operation data, as well as results

of tests conducted at a Naval Amphibious Training Base, are revealed.

The three configurations were as follows: (1) The basic installation to determine the practicability of the drive; (2) modifications to incorporate silencing and provide weather protection; and (3) installation in a watertight compartment with side exhaust in a second LCVP hull.

The turbine comprises a single-stage centrifugal compressor, direct-connected to a single-stage axial-flow turbine. Exhaust from the first stage drives a second or power-stage axial-flow turbine comparable in principle to a fluid transmission. The power rotor is contained in a gear case which reduces the speed to the output shaft from 8.62 to 1. Diesel fuel is burned in two diametrically opposite

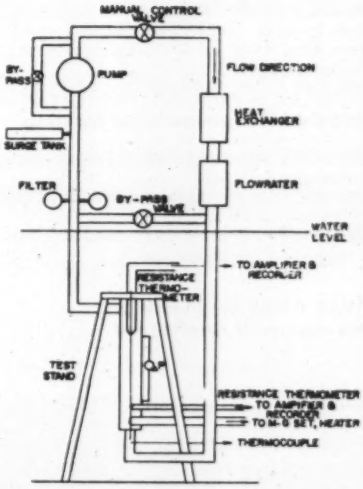
160-hp, 220-lb gas-turbine plant as installed in a U. S. Naval landing craft

mounted combustors that connect the compressor-discharge scroll to the first-stage nozzle box. Integral with the engine frame are all of the necessary auxiliaries for starting and sustaining operation. External requirements are fuel, lubricating-oil cooler and filter, and a 24-volt d-c supply. The first stage operates at 36,0000 rpm at rated speed and the maximum output shaft speed is 2750 rpm. The turbine is 40 in. long, 23 in. wide, and 23 in. high and weighs about 220 lb.

Heat Transfer

A Test Loop for Determining Heat-Transfer Coefficients by the Thermal-Cyclic Method, by L. S. Mims and J. A. Kleber, Westinghouse Electric Corporation, Pittsburgh, Pa. 1954 ASME Semi-Annual Meeting paper No. 54—SA-48 (mimeographed; available to April 1, 1955).

The thermal-cyclic method has two important advantages over the steady-state method of measuring convective film coefficients of surfaces with odd physical shapes. The usual steady-state method, based on the normal convective



Component parts of the test loop for determining heat-transfer coefficients by the thermal-cyclic principle

heat-transfer equation, requires that heat be made to flow continuously from the solid to the fluid. It also requires that the metal surface temperature be known. Both these disadvantages are eliminated in the thermal-cyclic method where heat is applied directly to the fluid and in which only the temperatures of the fluid inlet and outlet at the test section need be recorded.

A loop has been constructed at the Westinghouse Atomic Division which operates on the thermal-cyclic principle. This loop, which uses water as the fluid, was designed to operate in a range suitable to the cyclic-measuring theory.

Test data obtained show good correlation with the Colburn equation and the thermal-cyclic method has proved to be a useful tool in obtaining heat-transfer data. A possible future use may be to measure the effect of film deposits on heat-transfer coefficients.

Use of Numerical Analysis in Transient Solution of Two-Dimensional Heat-Transfer Problem With Natural and Forced Convection, by S. K. Hellman, Assoc. Mem. ASME, George Habetler, and Harold Babrov, Knolls Atomic Power Laboratory, General Electric Co., Schenectady, N. Y. 1954 ASME Semi-Annual Meeting paper No. 54—SA-53 (mimeographed; available to April 1, 1955).

In order to determine thermal stresses in a nuclear reactor during power build-up and decay, it is necessary to derive a method of evaluating the transient temperatures involved.

This paper presents an analysis of a two-dimensional metallic structure containing many flow channels. Cooling is accomplished through natural and forced convection. Heat generation and conduction are considered as functions of time and two space variables, while the laminar motion of the liquid metal is expressed by means of transient, one-dimensional flow-rate equations, derived from Euler's equation. The system is set up as a thermal network so that the resulting finite-difference equations can be solved by a digital computer.

Temperature Charts for Internal Heat Generation, by M. P. Heisler, North American Aviation, Inc., Downey, Calif. 1954 ASME Semi-Annual Meeting paper No. 54—SA-44 (mimeographed; available to April 1, 1955).

Thermal transients arising from internal generation occur in many fields. Among these are nuclear energy, electrical and electronic processes and equipment, metallurgical heat-treating and manufacturing, and industrial chemical and wood-laminate processes. Nonmetallic materials such as wood laminates, plastics, and ceramics are heated dielectrically and metallic materials inductively or by clamping electrodes to the body and passing current through it.

In the case of liquid or viscous materials such as glass, silicon carbide, and the like, electrodes are immersed within the material itself. Spars and other wood laminates are bonded by combined hot plate and dielectric heating, and this is amenable to analysis by a superposition of internal heat generation and uniform and constant surface temperature. The ratings of electrical motors, generators and transformers, and electronic equipment are often set by considerations of internal heat generation. The entire structure of a nuclear reactor is subjected to intense radiation fields and the absorption of these radiations sets up internal heat sources throughout the reactor structure.

In this paper a number of graphs are presented for determining transient heating effects in simple bodies having uniform internal heat sources. The range of parameters covers Fourier's modulus between 0 and ∞, and relative boundary resistance—also referred to as the inverse Biot or modified Nusselt number—between 0 and ∞. The full range of position variable is covered except for the case of Fourier's modulus less than 0.2. In this case the complete range is covered only for values of relative boundary resistance equal to zero.

An Electrolytic Analog Applied to the Solution of a Thermal-Conduction Problem, by P. E. McNall, Jr., and J. E. Janssen, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. 1954 ASME Semi-Annual Meeting paper No. 54—SA-45 (mimeographed; available to April 1, 1955).

A DESCRIPTION of an electrolytic-tray analog used in the determination of the temperature field within a transistor is presented. Special features which made possible the simulation of heat flow through several different materials connected at nonisothermal interfaces, controlled distribution of heat generation at a boundary, and interface thermal resistances are discussed. A treatment of the inherent errors is also presented.

The following conclusions are drawn:

1 The temperature field within a transistor was determined. A comparison of the analog results with direct temperature measurements made on a transistor is not possible at present since there is no known way to measure the temperature at the collector-base interface without altering the electrical characteristics of the device. Comparison of the analog results with indirect temperature determinations on transistors carried to "burn-out" temperatures indicates that the results were of practical accuracy.

2 The arrangement of the analog was very flexible and changes in configuration could be made quickly. Extra strips installed on the trays made it possible to change the contact area between two materials by merely soldering or unsoldering some of the strips. The size and shape of the trays were easily changed by inserting baffles.

3 Once the analog was set up no particular skill was required to make the measurements.

4 The modifications made in the commonly used electrolytic-tray analog to provide the simulation of heat generation at a boundary interface, which are not necessarily isothermal, and interface thermal resistances, make possible the extension of the applicability of the electrolytic-tray analog to many problems which may be much more difficult to solve by other means.

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A NUMBER of papers and reports were presented at ASME Meetings which were not preprinted nor published. Manuscript copies of these papers are on file for reference purposes in the Engineering Societies Library, 29 West 39th St., New York 18, N. Y. Photostatic copies of these unpublished papers may be secured from the Library at the rate of 40 cents per page. The following papers recently have been placed on file in the Engineering Societies Library:

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The ASME Junior and Professional Development, by R. Nelsen

The Education of Mechanical and Electrical Engineers in Mexico, by I. Avilez

The First Five Years of Professional Development, by K. B. McEachron, Jr.

1954 ASME Engineering-Management Conference

Executive Development Programs for Engineers, by E. G. Uhl

Selection and Training Sales Engineers, by H. G. Ebdon

Planning Research Programs, by C. C. Furnas

Evaluating Competitive Development Programs, by J. J. Greve and A. W. Hanson

ASME Transactions for July, 1954

THE July, 1954, issue of the Transactions of the ASME (available at $1 per copy to ASME members; $1.50 to nonmembers) contains the following:

Technical Papers

Design and Operation of High-Recovery Regenerative-Type Air Preheaters, by George Braddon and Joseph Waitkus. (53—F-22)

The Controlled-Circulation Boiler, by W. H. Armacost. (53—A-91)

Controlled Circulation at Chesterfield, by T. E. Crossan and W. F. Ryan. (53—A-96)

The New Kearny Generating Station, by F. P. Fairchild. (53—A-71)

An Experimental and Theoretical Investigation of Two-Dimensional Centrifugal-Pump Impellers, by A. J. Acosta.

The Kaplan Turbine—Design and Trends, by J. Fisch. (53—A-101)

Grand Coulee Model-Pump Investigation of Transient Pressures and Methods for Their Reduction, by E. Lindros. (53—A-213)

Vibration of the Grand Coulee Pump-Discharge Lines, by John Parmakian. (53—A-50)

Mechanical Features of the Tandem Helicopter Drive System, by W. F. Plume. (53—A-214)

Characteristics of a Vaporizing Combustor for Aviation Gas Turbines, by W. D. Pouchot and J. R. Hamm. (53—A-182)

Thermal Conductivity of Gases, by F. G. Keyes. (53—A-58)

Thermal Conductivity of Some Industrial Liquids From 0 to 100 C, by H. L. Mason. (53—A-40)

The Thermal Conductivity of Fluids, by A. F. Schmidt and B. H. Spurlock, Jr. (53—A-184)

The Thermal Conductivities of Some Organic Liquids, by M. F. Dick and D. W. McCready. (53—A-187)

Heat Transfer and Fluid Friction During Flow Across Banks of Tubes—V, by O. P. Bergelin, G. A. Brown, and A. P. Colburn. (53—A-173)

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54—SA-32	Methods and Costs in Coal Storage With Scrapers and Bulldozers, by D. K. Heiple
54—SA-33	Shall It Be a Crane, a Conveyer, or an Industrial Truck? by A. T. Gaudreau
54—SA-34	Flow of Solids in Bulk-Handling Systems, by A. W. Jenike

Metal Processing

54—SA-38	Maintenance and Production Tooling in a Steel Plant, by C. E. Youngblood
54—SA-57	The Grinding of Titanium Alloys, by C. T. Yang and M. C. Shaw

Metals Engineering

54—SA-35	The Punching of Medium-Carbon Steel, by S. K. Clark
54—SA-66	Titanium Technology in Mid-1954, by H. T. Clark, J. P. Catlin, and W. E. Gregg
54—SA-77	Sixty-Cycle Induction Heating of Large Steel Sections for Rolling, by C. H. Hartwig

Paper No.	Title and Author

Power

54—SA-37	Economic Comparison of River and Cooling-Tower Circulating-Water Systems, by J. Lichtenstein and B. C. Sprague
54—SA-58	The Thermal Design of Nuclear Power Reactors, by N. J. Palladino
54—SA-59	Working-Stress Criteria for Nuclear Power Plants, by B. F Langer
54—SA-60	The Mechanical Design of Liquid Metal-Cooled Nuclear Reactors, by C. R. Stahl
54—SA-62	Air-Preheater Size Selection to Improve Over-All Steam-Power-Plant Efficiency, by B. C. Mallory and W. F. Allen, Jr.
54—SA-65	Comparative Performance of Turbine-Generator Units in Saturated-Steam Cycles, by N. A. Beldecos and A. K. Smith
54—SA-69	Design of Steam-Piping Systems for Large Central-Station Applications, by R. L. Jackson and L. H. Johnson
54—SA-70	Analysis of Pipe Systems With Special Expansion Features, by J. E. Donahue
54—SA-75	Structural Problems of Sodium-Cooled Nuclear Reactor by D. R. Miller and W. E. Cooper

Process Industries

54—SA-16	Fanning Friction Factors for Air Flow at Low Absolute Pressure in Cylindircal Pipes, by W. J. Bohnet and L. S. Stinson
54—SA-17	A Graphical Representation of the Frictional Losses in Commercial Pipe of Air and Steam Flowing Turbulently at Low Pressure, by W. C. Knapp and J. W. Metzger

Production Engineering

54—SA-2	Interaction of Friction and Temperature at the Chip-Tool Interface in Metal Machining, by F. F. Ling and Edward Saibel
54—SA-8	Production-Engineering Curricula, Content, and Interest, by O. W. Boston
54—SA-14	A Periodic Re-Evaluation of Manufacturing Processes, by W. H. Friedlander
54—SA-15	Production Engineering—An Engineering Education, by I. L. Reis and K. J. Trigger

Rubber and Plastics

54—SA-67	Dielectric Breakdown Properties of Thermosetting Laminates, by N. A. Skow
54—SA-68	Weather Aging of Styrene and Phenolic Plastics, by J. R. Taylor and C. H. Adams

Coupons for Ordering ASME Papers

Pamphlet copies of the foregoing ASME 1954 Semi-Annual Meeting papers are available from the ASME Order Department, 29 West 39th Street, New York 18, N. Y.

To facilitate ordering of preprints and reprints of ASME papers, ten free coupons are now being supplied annually to every ASME member. Additional coupon books, each containing ten coupons, are available to members at $2 each; to nonmembers at $4 each.

For further details see page 684 of this issue.

Reviews of Books

And Notes on Books Received in Engineering Societies Library

Communication in Management

COMMUNICATION IN MANAGEMENT. By Charles E. Redfield. The University of Chicago Press, Chicago, Ill.; Cambridge University Press, London, England, 1953. Cloth, 5½ × 8⅜ in., figs., index, notes, bibliography, 290 pp., $3.75.

Reviewed by Gene M. Weeks[1]

"COMMUNICATION in Management" has been designed as a handbook rather than a text. The material is panoramic with only a bird's-eye glimpse of theory, and if, at times, the trivia and detailed procedures are burdensome, there is still no disputing the comprehensive excellence of the work.

As the subtitle indicates ("A Guide to Administrative Communication") the book has been compiled for the businessman. As such, many of the multidisciplinary problems that have concerned the social scientist are here almost oversimplified. Communication, according to the author, is essentially a problem of language—a modern language that has outstripped the average vocabulary or the usual literacy measures and which must convey its message to more complex and larger audiences. Although he is not sure whether size alone is the significant key to the problem, the author is convinced that communication difficulties are more apparent in large companies. He has accordingly devoted this study to an inventory of the tools and techniques available to the manager in a large institution. The many solutions are concerned principally with problems of vertical control and horizontal acceptance.

All of the material, however, is well documented and draws upon the most recent and best research studies from both industry and the university campus. It is well written, interesting, and generally informative, with sections on conference techniques and organizational patterns that are particularly well done.

Yet the presentation is simple and orderly, designed as a ready reference for the novice for whom it is written. As John L. McCaffrey, president of the International Harvester Company, sums it up in the preface: "Here the executive will find, in an orderly and systematic presentation, the fundamentals he needs to know about the problems of communication, about the techniques which have been usefully employed, about the basic difficulties involved, about the areas of certainty and the areas of doubt."

[1] Gene Weeks and Associates, New York, N. Y. Assoc. Mem. ASME.

Library Services

ENGINEERING Societies Library books may be borrowed by mail by ASME Members for a small handling charge. The Library also prepares bibliographies, maintains search and photostat services, and can provide microfilm copies of any items in its collection. Address inquiries to Ralph H. Phelps, Director, Engineering Societies Library, 29 West 39th St., New York 18, N. Y.

Books Received in Library...

CALCUL STATISTIQUE DES SYSTEMES ASSERVIS. By Marc J. Pélegrin. France, Ministère de l'Air, Publications Scientifiques et Techniques no. 285, 1953. 156 p., 10⅛ × 7⅛ in., paper. 1200 frs. The author provides a mathematical analysis of servomechanism behavior based on the communications theories of Norbert Wiener and Y. W. Lee. The generalization is then applied to nonlinear systems such as relays and automatic airplane pilots.

DENSENING AND CHILLING IN FOUNDRY WORK. By Edward Longden. Charles Griffin & Company, Ltd., London, England, 1954. 178 p., 9¼ × 6½ in., bound. 30s. The stress in this treatise is on the influence of various mold materials on the apparent structural soundness and density of castings in high-duty and general ions, carbon and alloy steels, malleable irons, and nonferrous alloys. Various types of denseners—refractory-coated sand-coated, etc.—are described, and their applications to a wide range of castings discussed. Design of chill molds and their use for car wheels, rolls, and so on, is also treated, and there is a separate chapter on densening by centrifugal action.

ELEMENTS OF MECHANISM. By Venton Levy Doughtie and Walter H. James. John Wiley and Sons, Inc., New York, N. Y., 1954. 494 p., 8¾ × 5¾ in., bound. $6. Completely rewritten, this edition of a standard textbook gives the fundamentals of kinematics in the field of mechanical movements. Early chapters cover motion in general, velocity and acceleration analysis, and linkages. Cams, gears, belts, and trains are considered in detail in the later chapters. The last chapter discusses miscellaneous mechanisms.

ENGINEERING MECHANICS. By Ferdinand L. Singer. Harper & Brothers, New York, N. Y., second edition, 1954. 525 p., 9½ × 6½ in., bound. $6. Fundamentals are presented in a manner that shows how they may be applied to practical engineering problems. As in the previous edition, both analytic and graphic methods are used, and equations have been interpreted in terms of their geometrical equivalents. The complete text has been rewritten, with some discussions expanded and others simplified. Summaries at the end of each chapter aim to make the text useful for a review of the subject in postcollege work.

FOUR-PLACE TABLES OF TRANSCENDENTAL FUNCTIONS. By W. Flügge. McGraw-Hill Book Company, Inc., New York, N. Y., 1954. 136 p., 9¼ × 6¼ in., bound. $5. Intended for the practicing engineer whose calculations are of the order of accuracy provided by a slide rule, these four-place tables cover trigonometric, hyperbolic, exponential, and logarithmic functions, certain of the Bessel functions, and a number of other special integrals and functions. Formulas needed in handling the functions are given, interpolation and extrapolation are provided for, and references to more extended tables are given.

GRAPHICS IN ENGINEERING AND SCIENCE. By A. S. Levens. John Wiley & Sons, Inc., New York, N. Y., 1954. 696 p., 9¾ × 7 in., bound. $7. Graphics is treated as a means of communication for the engineer and scientist. The first part emphasizes fundamental principles, primarily of orthogonal projection, and applies these to a variety of space problems in engineering. The second part covers standards; representation of threads and fasteners, cams, and gears; dimensioning practices; and the preparation of working drawings. Part three deals with graphical analysis and graphic methods of computation. Appendixes give symbols, standards, and other data, and there is a selected bibliography.

GUIDE TO TECHNICAL WRITING. By W. George Crouch and Robert L. Zetler. Ronald Press Company, New York, N. Y., second edition, 1954. 441 p., 8¾ × 5¾ in., bound. $5. This book, designed for both undergraduate students and those in industry, is concerned with the use of competent English in business letters, in technical reports, letters and articles, and in formal and informal oral communications. In the present edition the order of presentation has been altered and new specimen reports, memoranda, etc., have been added.

HYDRAULICS REFRESHER FOR PROFESSIONAL ENGINEERS LICENSE. By John D. Constance, 625 Hudson Terrace, Cliffside Park, N. J., first edition, 1954. Various pagings, 8½ × 11 in., paper. $2.75. A comprehensive selection of examination questions, with worked-out solutions, dealing with hydrostatics and hydrodynamics; circular orifices, weirs, pipe flow, and open channels; pumps and turbines;

Reynolds number, mechanism of fluid-flow, etc. Brief text review material precedes the illustrative problems in each case. The book is intended to be useful for practical engineering work as well as for examination review.

INTRODUCTION TO NUCLEAR ENGINEERING. By Richard Stephenson. McGraw-Hill Book Company, Inc., New York, N. Y., 1954. 387 p., 9¼ × 6¼ in., bound. $8. A survey of the nuclear-energy field for students, and for engineers who have completed the conventional courses. Following a brief review of nuclear physics, separate chapters discuss fission, the nuclear-chain reactor, reactor theory, radiation shielding, materials of construction, and instrumentation and control. There are also chapters on the separation of stable isotopes, chemical separations and processing, and on special techniques such as handling radioactive materials and the design of carriers for shipping them.

LIANTS HYDROCARBONÉS. Mortiers et Bétons Bitumineux. By Marius Duriez and Jean Arrambide. Dunod, Paris, France, 1954. 728 p., 11 × 7½ in., bound. 6300 fr. A comprehensive treatise on hydrocarbon-base binders. The introductory chapter reviews such topics as viscosity, plasticity, surface phenomena, and the nature of colloids. Succeeding chapters deal with the preparation, composition, and properties of coal and petroleum tars and their derived products; with the influence of time, temperature, and environment on their rheological characteristics; and with their use in highway and airport runway construction and as sealing materials for buildings and for dams, embankments, and other hydraulic structures. Tests, analyses, and specifications are given.

MACHINERY'S HANDBOOK. By Erik Oberg and F. D. Jones. Industrial Press, New York, N. Y., fifteenth edition, 1954. 1911 p., 7¼ × 5 in., bound. $9. Essential data and information on machine design and shop practice for the mechanical engineer, draftsman, toolmaker, and machinist are provided in this standard reference book. New material on recent or revised standards and on developments in designing and manufacturing has been added throughout. Some sections—for example, those on spur and bevel gears—have been considerably revised, and there is a new section on ball, roller, and needle bearings. As in previous editions, extensive technical and mechanical data are tabulated for convenient use.

PRINCIPLES OF INDUSTRIAL PSYCHOLOGY. By Thomas Arthur Ryan and Patricia Cain Smith. Ronald Press Company, New York, N. Y., 1954. 534 p., 8½ × 5¾ in., bound. $5.50. An introductory survey of the entire field presenting a complete summary of the results of research and practical experiments. It covers selection, placement, motivation, fatigue, and other questions of importance to management, labor, industrial engineers, and personnel directors. The authors point out what the industrial psychologist can and cannot do at the present time and suggest directions for future research.

TABLE OF SECANTS AND COSECANTS TO NINE SIGNIFICANT FIGURES AT HUNDREDTHS OF A DEGREE. (Applied Mathematics Series, no. 40.) National Bureau of Standards. Superintendent of Documents, G.P.O., Washington 25, D. C., 1954. 46 p., 10¼ × 7⅞ in., paper. $0.35. A companion volume to the previously published table of sines and cosines for decimal divisions of degrees. The customary explanatory introduction precedes the table.

TECHNISCHE WARMELEHRE. By Friedrich Wilhelm Winter. W. Giradet, Essen, Germany, 1954. 312 p., 8¼ × 6 in., bound. 19.80 DM. The basic principles of heat theory for solids, liquids, and gases are reviewed, followed by detailed analyses of technical and industrial applications: internal-combustion engines, steam, refrigerating machinery, the heat pump, heat production from fuels, turbines, and jet-propulsion devices.

THEORIE DES FONCTIONS ALEATOIRES. By A. Blanc-Lapierre and Robert Fortet. Masson et Cie, Paris, France, 1953. 693 p., 9⅜ × 6¾ in., bound. 6500 fr. An extensive development of the theory of random functions, rigorously handled for the mathematician, but in such a way as to facilitate a physical interpretation of the mathematical theory. In the latter part of the book sections are devoted to detailed accounts of two typical applications: to the problem of noise in telecommunications; and to the statistical and the dynamic approach to turbulence problems.

TURBINE- AND JET-PROPELLED AIRCRAFT POWERPLANTS. By James P. Eames. Chartwell House, Inc., New York, N. Y., 1954. 237 p., 8⅜ × 5¾ in., bound. $5.25. Operating characteristics and basic-design principles of compressorless jet, turbojet, turboprop, propjet, and rocket-jet powerplants are concisely described. Problems of maintenance and materials of construction are also treated briefly, and about half the book gives data on U. S. and foreign engines and planes.

ASME BOILER CODE

Interpretations

THE Boiler Code Committee meets monthly to consider "Cases" where users have found difficulty in interpreting the Code. These pass through the following procedure: (1) Inquiries are submitted by letter to the Secretary of the Boiler Code Committee, ASME, 29 West 39th Street, New York 18, N. Y.; (2) Copies are distributed to Committee members for study; (3) At the next Committee meeting interpretations are formulated to be submitted to the ASME Board on Codes and Standards, authorized by the Council of the Society to pass upon them; (4) They are submitted to the Board for action; (5) Those which are approved are sent to the inquirers and are published in MECHANICAL ENGINEERING.

(The following Case Interpretations were formulated at the Boiler Code Committee meeting April 28, 1954, and approved by the Board on June 23, 1954.)

CASE No. 1175

(Special Ruling)

Inquiry: May low-carbon, high-nickel steel plate, conforming to requirements of Specification SA-353, be used in the construction of unfired pressure vessels under Section VIII? Such vessels would be used for service below —20 F.

Reply: It is the opinion of the Committee that low-carbon, high-nickel steel plate, conforming to Specification SA-353, may be used in the construction of unfired pressure vessels provided the rules of design, fabrication, and inspection of the 1952 Unfired Pressure Vessel Code (Section VIII) are followed, with the following additional provisions:

(1) *Specifications*

The low-carbon, high-nickel steel plate shall conform to Specification SA-353.

(2) *Welding*

The welding requirements shall conform to the requirements of Section IX.

The classification of the material under Table Q-11.1 shall be P-10.

The reduced-section tension specimen shall have a tensile strength that is not less than the minimum of the specified tensile strength of the base material or of the weaker of the two if materials of different specified minimum tensile strength are used; except where Case No. 1182 provides for the use of weld metal at room temperature of lower strength than the base metal, in which case the weld metal shall satisfy the requirements of Case No. 1182.

(3) *Radiography*

All longitudinal and circumferential joints shall be double-butt welded and radiographed.

(4) *Thermal Stress-Relief*

Stress relieving shall be performed after fabrication by gradually and uniformly heating the vessel to a temperature between 1025 F and 1085 F, holding for a minimum of two hours for thickness up to one inch; plus a minimum of one hour for each additional inch of thickness and cooling in still atmosphere to a temperature not exceeding 600 F. The heating and cooling rates shall be in accordance with Section VIII.

(5) *Allowable Working Stress*

The allowable working stress values shall be 22,500 psi except as otherwise

provided in Case No. 1182 for weld metal of lower strength than the base metal.

(6) *Allowable Temperature*

The material shall be used at temperatures below —20 F.

CASE No. 1185

(Special Ruling)

Inquiry: Since aluminum alloys GS-11A-T6 and clad GS-11A-T6 are acceptable materials for vessels constructed in accordance with Section VIII and welding qualifications are included in the 1953 edition of Section IX, is it permissible to construct vessels of these materials by welding and, if so, what allowable stress values are to be used?

Reply: It is the opinion of the Committee that vessels of aluminum alloys GS-11A-T6 and clad GS-11A-T6 may be constructed by welding provided (1) the applicable rules of Section VIII are followed, (2) the qualification requirements of Section IX are met, (3) the stress values in the accompanying table are used where reference is made to stress values in Table UNF-23.

Alloy & Temper	Spec. No.	Maximum Allowable Stress Values for Metal Temperatures Not Exceeding Deg F 100	150	200	250	300	350	400
GS-11A-T6 and Clad GS-11A-T6	SB-178 SB-273 SB-274	6000	5900	5700	5400	5000	4200	3200

CASE No. 1186

(Special Ruling)

Inquiry: In view of the urgent need for new rules for Openings and Reinforcement, may the proposed revisions to Par. P-268 which were published in the May, 1954 issue of MECHANICAL ENGINEERING be used for constructions to the Power Boiler Code?

Reply: It is the opinion of the Committee that in view of the need for these new rules for present-day designs, and since the basic theory is currently being used for constructions to the Unfired Pressure Vessel Code, the proposed revisions to Par. P-268 may be used for constructions to the Power Boiler Code.

CASE No. 1187

(Special Ruling)

Inquiry: In designing a cylindrical jacketed vessel with staybolts between the jacket and inner shell, would it be permissible to calculate the jacket thickness by using the formula for cylindrical shells under internal pressure? This formula may require less thickness than the one for stayed surfaces when low pressures or small diameters are involved.

Reply: It is the opinion of the Committee that when a jacket extends completely around a cylindrical vessel, the jacket thickness shall be calculated by the formula for cylindrical shells under internal pressure in Par. UG-27(c), and also by the formula for braced and stayed surfaces in Par. UG-47(a), and that the greater of the thicknesses thus obtained shall be used.

Annulment of Cases

All Cases that refer to the 1949 Section VIII, Code for Unfired Pressure Vessels are to be annulled effective January 1, 1955. These Cases are contained in the first sixty-nine pages of the Case Interpretations booklet published February 1, 1953.

Proposed Revisions and Addenda to Boiler and Pressure Vessel Code . . .

AS NEED arises, the Boiler Code Committee entertains suggestions for revising its Codes. Revisions approved by the Committee are published here as proposed addenda to the Code to invite criticism. If and as finally approved by the ASME Board on Codes and Standards, and formally adopted by the Council, they are printed in the annual addenda supplements to the Code. Triennially the addenda are incorporated into a new edition of the Code.

In the following the paragraph numbers indicate where the proposed revisions would apply in the various sections of the Code.

Comments should be addressed to the Secretary of the Boiler Code Committee, ASME, 29 West 39th Street, New York 18, N. Y.

Power Boilers, 1952

TABLE P-15. Revise the Notes published with the revision to this table in the April, 1954, issue of MECHANICAL ENGINEERING to read:

[1] Adjusted pressure ratings for steam service at saturation temperature corresponding to the pressure derived from Tables 2 to 15, incl., of ASA B16.5–1953.

[2] Pressures shown include the factor for boiler feed and blowoff line service required by Pars. P-299(d) and P-310(c).

[3] Class A ratings apply to welding ends, ring joints, small tongue-and-groove facing with any type of gasket, large tongue-and-groove facing with any type of gasket, except flat solid metal, and other facings with gaskets which result in no increase in bolt load or flange moment over those previously mentioned.

Class B ratings apply to all facings and gaskets not specifically listed under Class A.

Material Specifications, 1952

The Boiler Code Committee has approved adding to Section II the following new specifications:

Plates
SA-7-53T
SA-129-53T
SA-201-53T
SA-202-53T
SA-203-53T
SA-204-53T
SA-212-53T
SA-225-53T
SA-285-53T
SA-299-53T
SA-300-53T
SA-301-53T
SA-302-53T
SA-353-53T

Tubular Products
SA-178-53T
SA-213-53T
SA-226-53T
SA-250-53T
SA-335-53T
SA-369-53T

Stainless Steel
SA-193-53aT
SA-194-53T
SA-213-53T
SA-249-53aT
SA-271-53
SA-320-53T

Forgings & Miscellaneous Materials
SA-182-53T
SA-193-53aT
SA-194-53T
SA-307-53T
SA-320-53T
SA-354-53T

Nonferrous Materials
SB-178-53T
SB-234-53T
SB-273-53T
SB-274-53T

Low-Pressure Heating Boilers, 1952

PREAMBLE Delete entire present Preamble and substitute the following:

These rules are divided into two sections: Part 1, applying to steel-plate boilers, and part 2, applying to cast iron boilers. The Code does not contain rules to cover all details of design and construction. Where complete details are not given, it is intended that the manufacturer, subject to the approval of the authorized inspector, shall provide details of design and construction which will be as safe as otherwise provided in these rules.

PAR. H-1(2) Revise to read:

(2) To hot-water heating and hot-water supply boilers to be operated at pressures not exceeding 160 psi and temperatures not exceeding 250 F;

PAR. H-1 Add as a new subparagraph (4):

(4) Except as provided in Par. H-1(5), the following classifications are considered not to be within the jurisdiction of this section of the Code.

(a) Hot-water supply boilers which are directly fired with oil, gas, or electricity when none of the following limitations is exceeded:

- a heat input of 100,000 Btu per hr;
- a water temperature of 200 F;
- a nominal water-containing capacity of 120 gal.

Add as a new subparagraph (5):

(5) All hot-water supply boilers, including those exempted in Par. H-1(4), shall be equipped with ASME-approved safety devices of proper type and size.

ASME NEWS

With Notes on the Engineering Profession

1954 ASME Fall Meeting, September 8–10, Stage for Milwaukee Section's 50th Anniversary Celebration

Looking east, Wisconsin Avenue—Milwaukee's "magnificent mile"—is the fast-moving downtown thoroughfare, uncluttered by streetcar tracks or trolley wires. The Court of Honor in the foreground is a lasting memorial to the veterans of all wars in which Milwaukee's citizens have been engaged. Note Hotel Schroeder, headquarters for 1954 ASME Meeting, Sept. 8–10.

Headquarters: Hotel Schroeder. Important Technical Papers, Inspection Trips, and Anniversary Celebration Events Round Out Program

Tentative Program

TUESDAY, SEPTEMBER 7

8:00 p.m.

Golden-Anniversary Gayeties Party

Old-Timers Movies, Square Dancing, etc. To be held at Milwaukee Engineering Societies Building

WEDNESDAY, SEPTEMBER 8

8:00 a.m.

Registration

9:30 a.m.

Fuels (I)

Four Years of Natural Gas in Milwaukee[1]

Small Boiler-Plant Design Considerations[1]

[1] See box on page 691.
[2] Presented by title only.

9:30 a.m.

Metals Engineering

The Influence of Repeated Loads on the Residual Stresses in Inelastically Deformed Beams, by *T. M. Eltesser* and *H. T. Corten,* University of Illinois (Paper No. 54—F-13)

The Effect of Size on the Load-Carrying Capacity of Steel Beams Subjected to Dead Loads, by *O. M. Sidebottom* and *M. E. Clark,* University of Illinois (Paper No. 54—F-12)

9:30 a.m.

Materials Handling (I)

Belt Conveyers in Bulk Handling[1]

Recent Developments in Conveyer Belting[1]

9:30 a.m.

Machine Design (I)—Production Engineering (I)

Progressive Transfer of Skills From Operator to Machine, by *W. G. Johnson,* Norton Co. (Paper No. 54—F-7)

The Electromagnetic Clutch—Its Operation, Application, and Control, by *H. B. Stallings,* I-T-E Circuit Breaker Co. (Paper No. 54—F-9)

Performance Operator,[2] by *B. G. Bromberg,* McDonnell Aircraft Corp. (Paper No. 54—F-6)

2:30 p.m.

Fuels (II)

The Burning of Sulphate, Soda, and Sulphite Waste Liquors, by *E. H. Kennedy,* Combustion Engineering, Inc. (Paper No. 54—F-32)

Design and Operational Aspects Regarding Utilization of North Dakota Lignite in Steam-Generating Plants, by *H. R. Cowles*, Otter Tail Power Co. (Paper No. 54—F-2)

2:30 p.m.

Materials Handling (II)

Material Handling and Automation[1]

2:30 p.m.

Machine Design (II)

Design of Power Spur-Gear Trains for Minimum Inertia, by *T. A. Stoner* and *C. B. Sipek*, Kearney & Trecker Corp. (Paper No. 54—F-8)

The Geometry of Crossed Helical Involute Gears, by *H. C. Gray*, The Falk Corp. (Paper No. 54—F-10)

2:30 p.m.

Junior (I)

Milwaukee Masters Manufacturing Through Engineering

Guests of the Old Guard

Milwaukee	Chicago
G. F. Leitner	*T. G. Gluck*
Rock River Valley	St. Joseph Valley
Minnesota	*J. A. Foster, Jr.*
Iowa-Illinois	Central Iowa
Central Illinois (Peoria)	Fort Wayne
	Central Indiana

2:30 p.m.

Lubrication Activity (I)—Machine Design (II-A)—Production Engineering (II)

Lubrication in the Machine-Tool Field[1]

Advantages of a Carefully Planned Lubrication Program[1]

7:00 p.m.

Plant Tour and "Gemütlichkeit" at Blatz Brewery

THURSDAY, SEPTEMBER 9

8:00 a.m.

Registration

8:30 a.m.

Inspection Trips

Chain Belt Company, Milwaukee, Wis.

A trip through a modern plant manufacturing chain, materials-handling equipment, and construction equipment. The trip includes the malleable-iron foundries.

Allis-Chalmers Manufacturing Company, West Allis, Wis.

A trip through plants of one of the world's leading manufactures of heavy machinery and tractors includes a visit to tractor shops, general machinery shop, and erection floor. Of special interest will be observation of turbine-test floor and 96-in. engine lathe for machining mill-shell heads and gears.

9:30 a.m.

Machine Design (III)—Lubrication Activity (II)

The Influence of Solid Particles in the Oil to Babbitt, Copper-Lead, and Aluminum Bearings, by *H. G. Rylander*, and *E. M. Wight*, University of Texas (Paper No. 54—F-11)

Approximate Synthesis of Four-Bar Linkages, by *Ferdinand Freudenstein*, Columbia University (Paper No. 54—F-14)

Semigraphical Solution of Acceleration of Plane Cam-Driven Roller Followers and Four-Bar Linkages,[3] by *Chun Hung Chiang*, Taiwain University (Paper No. 54—F-15)

9:30 a.m.

Heat Transfer (I)

Boiling From Small Wires With Emphasis on Transition Phenomena[1]

Discussion of Local Heat-Transfer Coefficients for Spheres and Cylinders, by *Irving Korobkin*, U. S. Naval Ordnance Lab. (Paper No. 54—F-18)

Heat Transfer in the Rotating-Element Air Preheater, by *C. M. Simmang*, Texas A&M, *F. T. Saadeh*, Minneapolis-Honeywell Regulator Co., and *B. E. Short*, University of Texas (Paper No. 54—F-22)

9:30 a.m.

Power (I)

Development Designs and Operating Experiences of the Oak Creek Power Plant, by *M. K. Drewry*, Wisconsin Electric Power Co. (Paper No. 54—F-24)

Preprint Orders

ONLY preprints of *numbered* ASME papers will be available. Some of these papers may not be available in time to permit your receiving them in advance of the meeting. Your order will be mailed only when the complete order can be filled unless you request that all papers available ten days before the meeting be mailed at that time. Please order only by paper *number;* otherwise the order will be returned. The final listing of available technical papers will be found in the issue of MECHANICAL ENGINEERING containing an account of the meeting.

Preprints of ASME papers may be obtained by writing to the ASME Order Department, 29 West 39th Street, New York 18, N. Y. Papers are priced at 25 cents each to members, 50 cents to nonmembers. Payment may be made by check, U. S. postage stamps, free coupons, or coupons which may be purchased from the Society. The coupons, in lots of ten, are $2 for members; $4 for nonmembers.

Preprints of unnumbered papers listed in the tentative program are not available because the review of these manuscripts had not been completed when the program went to press. The author's name and preprint number will appear with the paper title in the final program (final program available only at meeting) as well as the issue of MECHANICAL ENGINEERING containing an account of the meeting, if the paper is recommended for preprinting.

Symposium on Reheat-Turbine Protection

Factors Influencing Turbine-Generator Overspeed, by *E. G. Noyes, Jr.*, Westinghouse Electric Corp. (Paper No. 54—F-25)

Overspeed Protection of Reheat Turbine-Generators, by *M. A. Eggenberger*, General Electric Co. (Paper No. 54—F-26)

Reheat-Turbine Overspeed Protection, by *C. L. Ringle*, Allis-Chalmers Manufacturing Co. (Paper No. 54—F-31)

9:30 a.m.

Hydraulic (I)

Modern Trends in the Design of Hydraulic Turbine Governors, by *B. R. Nichols*, Allis-Chalmers Manufacturing Co. (Paper No. 54—F-17)

Economical Turbine Design for Marginal Hydroelectric Plants, by *A. R. Klann*, Allis-Chalmers Manufacturing Co. (Paper No. 54—F-16)

9:30 a.m.

Metal Processing (I)—Production Engineering (III)

A Modern Perspective of the Grinding Process, by *H. R. Letner*, Mellon Institute (Paper No. 54—F-4)

An Investigation of Cemented Tungsten Carbide as Bearing Material—Progress Report No. 2, by *J. S. Kosacka*, University of Illinois, *H. A. Erickson*, D. A. Stuart Oil Co., Ltd., *H. W. Highriter*, Vascoloy-Ramet Corp., and *A. S. Gabriel*, Acme Industrial Co. (Paper No. 54—F-3)

12:15 p.m.

President's Luncheon

Presiding: *Alex D. Bailey*, Past-President, Fellow ASME, vice-president, Commonwealth Edison Co., retired

Speaker: *Lewis K. Sillcox*, President, Hon. Mem. ASME

Subject: **Champions Are Not Complaisant**

2:30 p.m.

Machine Design (IV)—Junior (II)—Education (I)

Panel Discussion on: Developing the Young Engineer

Panel Members: *G. F. Habach*, Worthington Corp.; *Walter P. Schmitter*, The Falk Corp.; *Joseph E. Mulhein*, Jack & Heints, Inc.; and *W. M. Owen*, Caterpillar Tractor Co.

2:30 p.m.

Heat Transfer (II)

Heat-Transfer Rates for Cross Flow of Water Through a Tube Bank at Reynolds Numbers Up to a Million

Part 1—Average Film Coefficients for Individual Tubes, by *T. V. Sheehan*, Brookhaven National Lab., *R. T. Schomer*, The Babcock & Wilcox Co., and *O. E. Dwyer*, Brookhaven National Lab. (Paper No. 54—F-19)

Part 2—Circumferential Variations of Film Coefficients for Individual Tubes, by *O. E. Dwyer, T. V. Sheehan*, and *Joel Weisman*, Brookhaven National Lab. (Paper No. 54—F-20)

Part 3—Forced-Convection Boiling and Pressure-Drop Data, by *O. E. Dwyer, F. L. Horn*, and *Joel Weisman*, Brookhaven National Lab. (Paper No. 54—F-21)

2:30 p.m.

Power (II)

Thermodynamics of Supercritical-Pressure Steam-Power Plants[1]

Evaluation of Nonflammable Fluids as Steam-Turbine Lubricants[1]

2:30 p.m.

Hydraulic (II)

Evolution of Centrifugal-Pump Type From a Specific-Speed Standpoint[1]

Hydroelectric Systems in Brazil[1]

2:30 p.m.

Metal Processing (II)—Production Engineering (IV)

A Correlation Analysis of Machining Standards, by *R. D. Wills* and *Vernon Keenan*, Stevenson, Jordan & Harrison, Inc. (Paper No. 54—F-23)

The Incompatability of Predetermined Time Systems, by *L. C. Pigage* and *I. L. Reis*, University of Illinois (Paper No. 54—F-5)

6:30 p.m.

Banquet

Presiding: *W. J. Grede*, past-president NAM; President, Grede Foundries

Speaker: *M. J. Evans*, Mem. ASME, president, Melvin J. Evans Co., Chicago, Ill.

Subject: **People—The Clue to Greater Engineering Progress**

FRIDAY, SEPTEMBER 10

8:00 a.m.

Registration

8:30 a.m.

Inspection Trips

Kearney & Trecker Corp., West Allis, Wis.

A trip through the plants of one of the pioneers in the metalworking industry. In addition to a visit through the Standard Machinery Division, of special interest, a trip through their new Special Machinery Division, a recent $5 million expansion including $2½ million worth of latest machine tools, has been arranged.

Oak Creek Power Plant, Wisconsin Electric Power Co.

A trip through the new Oak Creek Power Plan designed for an ultimate of four units, each rated at 120,000 kw. Visitors will be able to observe such unconventional design features as "fair weather" coal-boat slip, furnace under-arch platen walls, controlled-circulation boiler, compact cross-compound turbines, and asbestos-cement siding. One of four units only in operation since November, 1953.

Milling-machine assembly at the Standard Machinery Division plant of Kearney & Trecker Corporation, one of the several plants to be seen on the scheduled inspection trips during the 1954 ASME Fall Meeting in Milwaukee, Sept. 10

9:30 a.m.

Power (III)

Symposium on Package-Type Industrial Boilers

Design and Operation of Fully Automatic Shop-Assembled Boilers, by *E. A. Kasmierski*, The Babcock & Wilcox Co. (Paper No. 54—F-30)

Selection of Control Equipment for Packaged Water-Tube Steam Generators, by *A. W. Hindenlang*, Combustion Engineering, Inc. (Paper No. 54—F-29)

Recent Development in Packaged Fire-Tube Boilers, by *F. A. Loebel*, Cleaver-Brooks Co. (Paper No. 54—F-27)

The Application of Automatically Controlled Water-Tube Packaged Steam Generators, by *E. J. Lachner*, Foster Wheeler Corp. (Paper No. 54—F-28)

9:30 a.m.

Production Engineering (V)

Panel on: What Does the Production Engineer Expect From New Machine Tools?

Machine Tools for Automation, by *N. L. Bean*, Ford Motor Co.

Machine Tools for Small-Lot Production, by *C. H. Borneman*, General Electric Co.

Machine Tools for Best Tool Performance, by *C. J. Oxford, Sr.*, National Twist Drill and Tool Co.

Machine Tools for the Aircraft Industry, by *M. Field*, Metcut Research Associates

9:30 a.m.

Management (I)

Notes on the Engineering Development of Industrial Products[1]

Can Your Company Survive Without New Products?[1]

Market Research for the New Product—Idea Through Design[1]

9:30 a.m.

Education (II)—EMC of EJC

Engineering Education in Russia[1]

Engineering Education—American Style[1]

An Industrial Community's Approach to Technical Education[1]

9:30 a.m.

Gas Turbine Power (I)

Gas-Turbine Power-Plant Testing[1]

Gas-Turbine Factory Testing[1]

2:30 p.m.

Production Engineering (VI)

Panel on: How Can the Production Engineer Apply the Results of Metal-Cutting Research

A. B. Albrecht, The Monarch Machine Tool Co.; *O. W. Boston*, University of Michigan; *E. H. Lee*, Brown University; *M. Eugene Merchant*, The Cincinnati Milling Machine Co.; *E. Neubauer*, The Trane Co.; *Jesse Sdano*, Allis-Chalmers Manufacturing Co.; and *M. C. Shaw*, Massachusetts Institute of Technology

2:30 p.m.

Management (II)

Designing for Production[1]

The Economic Direction of Methods Development[1]

Developing the Sales Organization[1]

2:30 p.m.

Gas Turbine Power (II)

Acceptance and Operational Tests of a 4250-Hp Coal-Burning Gas Turbine, Parts 1 and 2[1]

2:30 p.m.

Railroad

Some Remarks on the Theory of Maintenance of Rolling Stock, by *R. R. Crane* and *F. B. Brown, Jr.*, Westinghouse Air Brake Co. (Paper No. 54—F-1)

Registration Schedule

Tuesday, Sept. 7 3:00 p.m. to 5:00 p.m.

Wednesday, Sept. 8 8:00 a.m. to 5:00 p.m.

Thursday, Sept. 9 8:00 a.m. to 5:00 p.m.

Friday, Sept. 10 8:00 a.m. to 3:00 p.m.

WOMEN'S PROGRAM

TUESDAY, SEPTEMBER 7

2:00 p.m. Registration

8:00 p.m. Golden-Anniversary Gayeties Party

WEDNESDAY, SEPTEMBER 8

9:00 a.m. Registration

12:00 Noon Luncheon—Chalet-on-the-Lake

7:00 p.m. Plant Tour and "Gemütlichkeit" at Blatz Brewery

THURSDAY, SEPTEMBER 9

9:00 a.m. Registration

12:15 p.m. President's Luncheon

3:00 p.m. Tour of Charles Allis Art Library

6:30 p.m. Banquet

FRIDAY, SEPTEMBER 10

9:00 a.m. Registration

11:00 a.m. Brunch at White Manor Inn

EJC Issues Study of Income of Engineers

INFORMATION covering the professional income of about 72,000 engineers employed in industry, government, and engineering education has been made available by Engineers Joint Council in a 32-page publication entitled "Professional Income of Engineers—1953."

Representing the final report of a survey conducted in 1953 by the EJC Special Surveys Committee, the present publication is said to provide the most comprehensive study of engineering professional income since "The Engineering Profession in Transition," 1947.

It is available from Engineers Joint Council, 29 West 39th Street, New York 18, N. Y., at $2 a copy, with a discount of 50 per cent for single copies to members of the constituent EJC societies.

ESL Bibliography on Filing, Classification, and Indexing Systems

THIS is a selected list of references prepared for engineers and librarians concerned with organizing their own files, or the files in the engineering offices, or libraries where they work. The references are to articles in magazines, books, and pamphlets on filing, classification, and indexing, lists of subject headings, and hand-sorted punched-card systems. Some of the listed items are general—some related to specific subject fields.

There is a four-page introduction in which selection and use of the systems are discussed.

ESL Bibliography No. 9: Bibliography on Filing, Classification, and Indexing Systems for Engineering Offices and Libraries. 79 annotated references. 18 p. Mimeographed. 1954. $2. Available from the Engineering Societies Library, 29 West 39th Street, New York 18, N. Y.

ASME President L. K. Sillcox delivering principal address entitled "Paths We Pursue" during President's Luncheon. Shown, *left* to *right*, are Thompson Chandler, E. G. de Coriolis, W. F. Thompson, Ben George Elliott, Henry R. Kessler, E. W. Jacobson, C. E. Davies, Mr. Sillcox, R. J. S. Pigott, Mayor David L. Lawrence, Mrs. P. D. Oesterle, J. T. Bunting, P. R. Yopp, C. H. Shumaker, W. G. McLean, and V. A. Peterson.

Industrial Pittsburgh Plays Host to 1954 ASME Semi-Annual Meeting

Large technical program, inspection trips, and social events round out five-day activity

With its large concentration of mechanical-engineering industry and varied research activities in many fields, Pittsburgh, Pa., was a "natural" for the Semi-Annual Meeting of The American Society of Mechanical Engineers, held June 20–24, 1954, in co-operation with the Pittsburgh Section. Some 1200 ASME members, their wives, and guests registered at the William Penn Hotel headquarters for the Meeting.

Theme of this Meeting was "Community Progress—A Challenge to the Engineer." Featured speakers included Raymond R. Tucker, Mayor of St. Louis, Mo., who gave the Roy V. Wright Lecture; A. B. Van Buskirk, chairman of the Allegheny Conference on Community Development, who addressed the banquet; Lewis K. Sillcox, President ASME, who gave the principal address at the President's Luncheon; and Crosby Field, president, Flakice Corporation, Brooklyn, N. Y., who spoke at the Machine Design Luncheon.

The technical program, one of the largest ever scheduled for a Semi-Annual Meeting, consisted of 35 technical sessions at which some 90 papers were presented.

Wednesday was devoted to inspection trips to eight facilities in and around Pittsburgh. There were no technical sessions in the afternoon.

In addition, the ASME Woman's Auxiliary scheduled numerous special events to accommodate the women present.

President's Luncheon

Speaking at the President's Luncheon on Monday, the first major event of the Meeting, ASME President L. K. Sillcox paid tribute to George Westinghouse. A Pittsburgher, Westinghouse served as ASME President in 1910.

George Westinghouse, Mr. Sillcox said, made modern railroading possible, and modern railroading made possible the giant industrial complex that is America today. The accomplishments of Westinghouse, he said, have, in fact, changed the face of the earth for there is hardly a corner of the globe where people do not live better because he helped make it practical to move goods and people by rail.

Although honored in almost every way by the engineering world, the greatest monument to Westinghouse lies in his engineering accomplishments, the ASME President declared. For Westinghouse made modern and safe railway operation possible through his invention of the air brake, the friction draft gear, and automatic train control by signal indication. His vast contribution to the electric-power industry, Mr. Sillcox said, was no less compelling or significant.

In his address "Paths We Pursue," Mr. Sillcox denied that science has "reduced the beauty and mystery of the universe to something cold and mechanical."

Instead, he stated, science has "given back to the universe that quality of inexhaustible richness and unexpectedness and wonder which at one time it seemed to have taken away from it."

Science, Dr. Sillcox said, is a way of organizing reproducible knowledge about such problems as are subject to the basic laws of logic and are for the most part measurable. It is, further, a way of focusing and disciplining imagination, of weighing evidence, of deciding what is relevant and what is not, or impartially testing hypotheses; of ruthlessly discarding data that prove to be inaccurate or inadequate, of finding, interpreting, and facing facts, and of making the facts of nature the servants of man. Science is sometimes regarded as organized common sense. Scientific facts are the same to everybody, he said. They are facts that can be recognized as true regardless of the particular idiosyncracies of the individual who looks at them. There is something very sacred about humility before the facts as represented by a Pasteur or a New-

ASME Officers Nominated for 1954

Members of the ASME Nominating Committee for 1954, R. S. Stover, *chairman*, R. C. Robertson, *secretary*, L. E. Seeley, P. C. Osterman, S. B. Sexton, 3rd, E. W. Allardt, S. T. Johnson, and C. A. Stevens, have nominated for 1955 the following:

OFFICE	NOMINEE
President	David W. R. Morgan
Vice-President (for two years)	William H. Byrne, Region II
	J. B. Jones, Region IV
	Ben G. Elliott, Region VI (renominated)
	Clifford H. Shumaker Region VIII (renominated)
Directors at Large (for four years)	George A. Hawkins
	Harold C. R. Carlson
	Louis Polk (one year)

Biographical sketches of the candidates for office appear elsewhere in this issue of Mechanical Engineering.

Leading off the Banquet program is toastmaster H. N. Muller, Jr. Seated on the dais are, *left* to *right*, J. T. Bunting, D. W. R. Morgan, Ken Treschow, F. S. Blackall, jr., A. B. Van Buskirk, Mr. Muller, L. K. Sillcox, Byron E. Rhodes, J. Calvin Brown, A. D. Bailey, C. E. Davies, and D. W. Ver Planck. Approximately 400 engineers and their guests attended the gala function

Here, there, and everywhere at the Pittsburgh Meeting

A. B. Van Buskirk tells audience "The Pittsburgh Story" as principal speaker during the Semi-Annual Meeting Banquet

"Creative Engineering" was Crosby Field's topic for his address to the Machine - Design Luncheon audience

Mayor Raymond R. Tucker of St. Louis, Mo., delivering the Roy V. Wright Lecture on the engineer and his civic duty. He told the engineers their skills are needed in Government.

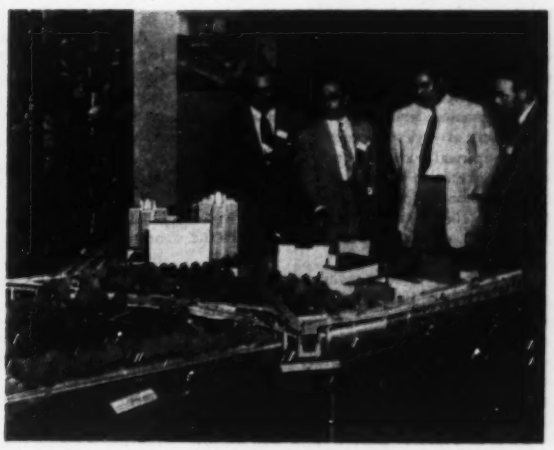
Shown, *left* to *right*, with ASME President L. K. Sillcox, are W. F. Rockwell, Fred Denig, and J. Roy Tanner, recently elected Fellows of ASME from Pittsburgh (Pa.) Section

During technical sessions Lucretia M. Whitney, *left photo,* describes an exhaust-gas-analysis instrument; B. F. Langer, *center photo,* discusses nuclear power plants; and in *right photo,* Hans Pfenninger, chief engineer, Gas-Turbine Division, Brown Boveri & Company, Ltd., Baden, Switzerland, who spoke on gas-turbine plants, is shown with George Krapf, *extreme right.*

President Sillcox, *center,* presents Machine Design Division Award to J. F. Blackburn, *left,* as C. Higbie Young looks on

An interested group listens to a discussion of high-speed heating of steel during a Metals Engineering Division session

Engineers view demonstration of Hi-Jet machining technique in which a jet of cutting oil under high pressure is directed on the cutting edge of the tool from below, during plant inspection visit to Gulf Research Laboratories, Harmarville, Pa.



Looking over model of Pittsburgh's redevelopment project of the Golden Triangle are, *left* to *right:* Past-President E. W. O'Brien, J. R. Aikins, chairman, 1954 ASME Semi-Annual Meeting Committee; C. J. Fletcher, and K. H. Strauss

Wreath-Laying Ceremony was held June 23 at the Westinghouse Memorial out in Schenley Park. Shown, *left* to *right*, are L. E. Osborne, executive vice-president, Westinghouse Electric Corporation; Herbert May, executive vice-president, Westinghouse Air Brake Company; ASME President L. K. Sillcox and honorary vice-president, Westinghouse Air Brake Company; and C. E. Davies, secretary of ASME.

ton. Science seeks to understand what the world is like, and what man is like as part of the world. Science cannot describe life without appeal to theories and hypotheses, critical judgments, and proposed explanations. But science always seeks to root its knowledge in an empirical, experimental reference. Thus the interpretative aspects of science, like the electron theory, for example, are justified attempts to clarify man's concept of the world about him and are ultimately dedicated to the descriptive goal.

To welcome ASME members and guests, Mayor David L. Lawrence of Pittsburgh, personally extended greetings on behalf of the city. He cited Pittsburgh's great mechanical-engineering industries, the city's smoke-control and flood-control accomplishments, and the many new buildings, parking facilities, and parks now under construction.

R. J. S. Pigott, past-president and Fellow ASME, who presided, read and displayed a Proclamation signed by Mayor Lawrence which declared June 20–24, 1954, to be Mechanical-Engineering Week in Pittsburgh.

As part of the program, Ernest G. de Coriolis, director of research, Surface Combustion Corporation, Toledo, Ohio, was named a Fellow of ASME. A Fellow certificate was presented to Mr. de Coriolis by President Sillcox.

Machine-Design Luncheon

Creative engineering is the act of creating a new visualization of an application of established engineering principles. This definition was set forth by Crosby Field, Fellow ASME, president, Flakice Corporation, Brooklyn, N. Y., the principal speaker during Tuesday's Machine-Design Luncheon. In general, he said, both the inventor and the creative engineer spend too much time concentrating on the technical problems at hand instead of watching social and market trends that have an important influence on their ultimate success.

The most remunerative opportunity for the creative engineer, according to Mr. Field, lies not in the perfection of design of machines already commercial, but in the discovery of a new material making a new method possible.

For example, he pointed out, a great chance for the creative engineer lies in the fact that there is a certain volume of production of a given product when a so-called continuous process becomes more economical than a "batch" process. Converting from the latter to the former requires new equipment, often some of it of a nature previously quite unknown in the industry.

However, he cautioned, it must be remembered when considering continuous versus batch processes, that factory cost is only one element of cost. Distribution costs are the elements which are now ever increasing and which may even absorb all the savings in a continuous process. On the over-all basis, Mr. Field said, several plants throughout the country, using batch processes, may prove more economical than one plant having a volume large enough to justify a continuous process.

Turning to decentralization, Mr. Field said that we are now definitely in the era of decentralization and that fear of atomic missiles will accelerate the trend toward it. One great opportunity for the creative engineer, therefore, during the next decade at least, lies in the design of efficient machines for relatively small production which can be spread throughout the country—for example, the "do-it-yourself" equipment.

As part of the luncheon program, Dr. J. F. Blackburn of the Dynamic Analysis and Control Laboratory, Massachusetts Institute of Technology, was presented a Machine Design Division Award for his papers on hydraulic control. President Sillcox made the presentation. Prof. C. Higbie Young presided.

"Pittsburgh Story" Told at Banquet

The story of Pittsburgh's progress was told to ASME members and guests attending the banquet, Wednesday evening, by Arthur B. Van Buskirk, chairman of the Allegheny Conference for Community Development. Mr. Van Buskirk listed these high lights of Pittsburgh's redevelopment program in rapid-fire order:

A cleaner city, with 70 per cent less smoke and 69 per cent more sunshine, saving local taxpayers $27 million a year; near-completion of a $100 million flood-control program; downtown reconstruction involving more than a fourth of the Golden Triangle's 325 areas; improved transportation facilities, including a new Greater Pittsburgh Airport and widespread highway construction; extensive industrial redevelopment, as typified by Jones & Laughlin Steel Corporation's $70 million program on the South Side, in the course of which "20 acres were acquired and 200 families were moved, with the co-operation of the local unions and without a single appeal to the courts"; educational and cultural programs such as the multimillion-dollar endowments made to the University of Pittsburgh's Medical School, the $6 million gift for Carnegie Tech's School of Industrial Administration, the lower Hill District redevelopment program, and a $4 million park and recreation fund.

Mr. Van Buskirk followed his outline of Pittsburgh's accomplishments with a plea to

the assembled engineers to consider moving their headquarters here. He said:

"We hope that you and your associates in the Founder Societies of the United Engineering Trustees will choose Pittsburgh as the place for your new home.

"This is the capital of the world in so far as steel, aluminum, and coal are concerned," he said. It is a major center in the management of the electrical and glass industries. It is doubtful that any city of the world embraces so many extensive laboratories for scientific and industrial research.

"You will see," he added, "a natural relationship between this dynamic and vigorous industrial community, with its great technical and scientific research facilities, and the natural aspirations of your organizations."

Also featured on the evening's program was the announcement of the following members who had completed 50 years of service in ASME; George Arnold, Jr., John Flinn Ancona, John H. Fox, and Samuel S. Wyer.

In addition, Fellow certificates were presented to Col. W. F. Rockwell, J. Roy Tanner, Fred Denig, and W. B. Drake.

Henry N. Muller, Jr., acted as banquet toastmaster.

Roy V. Wright Lecture

Raymond R. Tucker, member ASME, Mayor of St. Louis, Mo., in his presentation of the Roy V. Wright Lecture, warned his fellow engineers against being "too proud to come down into the arena of influence, the actual market place of public affairs."

Mayor Tucker called objectivity the engineer's prime qualification for participation in politics.

The engineer, he said, "must be objective in order to be a successful engineer. He is a careful person, given to cautious and careful analysis of all sides of a problem before he makes a decision. He is a judicious person, not subject to purely emotional appeals or to the razzle-dazzle of insincere propaganda. He is a studious person, who realizes that action without adequate knowledge is both foolish and dangerous."

Mayor Tucker pointed up the engineer's importance to the modern city by saying:

"In essence, municipal government is the process of providing services to the citizen—protecting his health and his safety, providing him with streets, lights, water, parks, playgrounds, libraries, and zoos, disposing of his wastes and protecting him against the vagaries of nature, his own carelessness, and the weaknesses of others."

"In fact," he added, "in virtually every significant field of local governmental activity, the knowledges, the aptitudes, and the skills of the professional engineer have been listed and adapted."

The Roy V. Wright Lecture was established in 1949, in honor of a former president of ASME. It serves as a tribute to his "contributions as a citizen to the nation and his community and in recognition of the stimulus his speech and leadership gave to all engineers in discharging the duties of good citizenship."

Diversified Technical Program Offered

A wide variety of technical material, engineering reports, and research papers were included among the more than 90 papers presented during the Meeting.

Subjects covered ran from atomic-power problems and air-pollution studies to rubber O-ring design and titanium technology. Some of the high lights follow:

Intended for integration with other investigations being made on atomic energy as a source of power generation, a Power Division paper extended performance data for central-station turbine-generator units of 100-mw capability into the region of saturated steam where few or no data are available for large unit ratings. Such studies have been made necessary because physical properties of nuclear-reactor structures impose limitations on the outlet steam temperature so that turbine throttle conditions differ radically from the modern trend.

Two engineers outlined different adaptations of the gas turbine in two papers which may broaden the useful fields of this new prime mover. Improvements to the gas-turbine heat cycle were demonstrated through utilization of waste heat in the exhaust to generate steam which is introduced into the turbine. It was said that lower cost per horsepower for equipment, and lower fuel consumption per horsepower generated, can be attained by adding steam to the air in the gas-turbine process. Substantial increases in both capability and thermal efficiency can be expected. In the other paper the operating and maintenance histories of gas turbines operating on blast-furnace gas in the steel industry were discussed. Reviewing the records of these plants, it was pointed out that the gas turbine shows real promise as a useful power plant for the steel industry, and that it can compete successfully with other types of prime movers.

Thermal diffusivity of two aluminum alloys, 3S and 61S, which are commonly used for welding purposes, shows little or no increase with temperature between 150 F and 1000 F. This conclusion, of practical importance to welding aluminum, is the result of a new experimental procedure and instrumentation developed for metals of relatively high thermal diffusivity, according to a Heat Transfer Division paper.

Periodic re-evaluations of manufacturing processes to keep them efficient and up to date can pay off in large savings in time, equipment, and personnel. This was the thesis of a Production Engineering paper. The three points to be followed in setting up a procedure for periodic re-evaluations of production processes include: (1) Plan, (2) organization, and (3) follow-up.

Forty per cent of all industrial executives are reported to be engineers, and 60 per cent of engineers are engaged in administrative functions 20 years after graduation, according to a Management paper. This paper contended that even these high figures could be raised if engineers practiced better engineering administration and applied engineering principles to administrative problems.

A practical solution to the problem of designing bins and hoppers quantitatively is in sight, it was announced in a Materials Handling paper. A "flow-factor" concept of a bulk solid and a method and apparatus to measure flow factors, employing simple formulas governing the flow of bulk solids, was presented. The formulas contain coefficients that depend on the shape and size of the bin or hopper. These coefficients have yet to be established experimentally.

A Metals Processing paper cited examples of how modernization of machines and the use of carbide tooling shorten machining time. In one instance production was increased 300 per cent on two engine lathes finishing axle barrels. These two machines, it was said, formerly produced a combined total of 15 axles per turn.

The establishment of shock tests in qualification of equipment for military service has necessitated development of better methods of making such tests, it was stated in a Machine Design paper. The most promising technique appears to be designing on the basis of the response spectrums for the shock motions produced by the shock-testing machines. The actual equipment is then designed by considering the equipment structures to be analogous to simple elastic systems to which the spectrums pertain.

A Rubber and Plastics report covered the effects of weather on styrene and phenolic plastic materials after exposure of up to four years. It was concluded that the weather factors contributing most to degradation of exposed specimens were ultraviolet radiation, humidity, rain and dust erosion, and temperature.

The Metals Engineering Division covered, among other subjects, the high-speed heating of steel and titanium technology, including grinding, machining, welding, and fabricating techniques.

Other subjects discussed included a Safety Panel in "Engineered Safety," and numerous papers covered Instruments and Regulators, Lubrication, Fuels, Aviation, and Process Industries.

In addition, the American Rocket Society, an affiliate of ASME, scheduled two technical sessions at which materials for rocket and jet propulsion were discussed.

Digests of many of the available ASME Semi-Annual Meeting papers may be found in this month's ASME Technical Digest.

Inspection Trips

Wednesday afternoon was devoted to inspection trips to the following companies: Gulf Research Laboratories, Harmarville, Pa.; Westinghouse Electric Corporation, East Pittsburgh Works; Union Switch and Signal Division of Westinghouse Air Brake Company, Swissvale, Pa.; Rockwell Manufacturing Company, Pittsburgh; Fisher Body Division, General Motors Corporation, McKeesport, Pa.; Duquesne Light Company, Elrama Station, Elrama, Pa.; and Mine Safety Appliances Company, Pittsburgh.

At Gulf Research the tour covered the engineering and engine test floors, the knock engine and dynamometer stations, as well as the Entomology Laboratory, the machine shop, and the pilot-plant equipment dupli-

The Women's Program was highlighted by a sight-seeing river trip arranged by Dravo Corporation

cating, on a small scale, major refinery units.

Of special interest to ASME visitors at Westinghouse was the huge, newly completed production aisle for producing large electric generators and motors.

At Union Switch the visitors saw a new heat-treating plant, an electric plating mill capable of handling any type of metal, the production and demonstration of railroad-signal apparatus, and the production and a demonstration of jet-aircraft flight trainers.

The manufacture of Nordstrom valves, gas and liquid meters, air hydraulic drill heads, and Delta-Rockwell industrial and homecraft power tools was inspected at Rockwell.

The tour to Jones & Laughlin's South Side Works covered the open hearth, blooming mill, strip mill, and bar mill.

Facilities seen at Fisher Body included large presses for making body parts from coils and flats. Subassembly lines, load center substations feeding power directly to heavy presses, and special car-loading techniques were also inspected.

At Duquesne's Elrama Station the visitors inspected the two 80,000-kw single-boiler turbine units now in service. They also saw the new 100,000-kw single-boiler reheat unit under construction.

Mine Safety showed the visitors the manufacture of standard apparatus and instruments and research and development facilities for new products.

In addition, informal inspection trips were specially arranged to the United States Bureau of Mines, Hagan Corporation, and the Alcoa Building, all in Pittsburgh.

Women's Program

The special events scheduled for the women got under way on Sunday afternoon with a social hour at the William Penn. This was followed by the motion picture, "Pittsburgh Builds for the Future." On Monday afternoon they took a river boat trip arranged by the Dravo Corporation. In the evening another film and lecture story of the "Rebirth of Pittsburgh" was shown. Featured on Tuesday were a luncheon and entertainment at the Pittsburgh Field Club and a sight-seeing tour of the Greater Pittsburgh Airport. On Wednesday morning the women took a sight-seeing trip through the city. This was followed by luncheon at one of the Gateway Center buildings. J. Calvin Brown, a past-president of ASME, was the principal speaker. His subject was "Women of Achievement." A tour of the H. J. Heinz Plant with luncheon was the principal event on Thursday.

Committees in Charge

The following committees contributed greatly to the success of the Meeting: *General Committee:* J. T. Bunting, *chairman;* D. W. Ver Planck, *vice-chairman;* R. W. Leathers, *secretary; Finance:* T. Fort, *chairman;* K. F. Treschow, *treasurer;* F. S. Bloom, C. R. Burlingame, W. I. Collins, Fred Denig, J. E. Graf, C. F. Kottcamp, A. H. Moore, J. E. Payne, S. M. Rust, Jr.; C. A. Wiken; *Technical Events:* E. W. Jacobson, *chairman;* N. L. Buck, *vice-chairman;* N. H. Eckler, *secretary;* R. Baudry, A. L. Bayles, M. F. Behar, R. M. Buchanan, H. M. Cather, J. P. Critchlow, J. Eazor, Jr., J. W. Griffiths, A. J. Kerr, M. R. McConnell, W. M. McConnell, D. J. McLaughlin, E. C. Payne, H. A. Pietsch, F. Ross, H. T. Silverman, P. E. Vesilind, Stewart Way, H. J. Wharton, C. A. Wiken, D. Wilson, C. T. Zoltani; *Reception:* P. D. Oesterle, *chairman;* W. F. Waina, *vice-chairman;* L. B. Abrams, J. R. Aikins, R. M. Buchanan, D. B. Burland, C. B. Cochrane, R. B. Dodds, R. B. Donworth, W. V. Drake, R. B. Foley, J. S. Gibson, H. H. Hauth, E. S. Howarth, W. S. Major, D. J. McLaughlin, E. C. Payne, C. W. Punton, T. E. Purcell, L. N. Scharnberg, J. A. Schultz, M. D. Stone, Leo Tattersall, C. M. Tyler, D. W. Ver Planck, M. J. Warneke; *Hotel:* K. F. Treschow, *chairman; Entertainment:* P. T. Lagrone, *chairman;* M. J. Wohlgemuth, *vice-chairman;* W. I. Collins, J. P. Critchlow, F. C. Engel, H. F. Hanson, J. E. Harder, M. S. Jacobs, R. M. Schneider, J. K. Stewart, L. E. F. Wahrenburg; *Plant Trips:* C. R. Burlingame, *chairman;* J. A. MacLachlan, *vice-chairman;* J. H. Baisley, J. M. Bendot, W. V. Drake, G. W. Edmunds, S. B. Floyd, Jr., H. H. Hall, James Maloney, R. G. Newton, R. S. Rochford, J. N. Welsh, R. E. Zinkham; *Printing and Signs:* R. A. Cederberg, *chairman;* R. S. MacQuown, *vice-chairman; Information and Registration:* H. R. Fulton, *chairman;* Christian Wilson, *vice-chairman;* G. W. Betz, H. R. Camp, G. E. Geiger, G. W. Gitlitz, C. D. Hartman, H. T. McCarthy, W. B. McQuiston, J. F. Parmley, K. P. Powers, H. O. Semler, W. P. Welch, J. E. Wilhelm; *Publicity:* J. R. Aikins, *chairman;* A. N. Stratmoen, *vice-chairman.* J. F. Coogan, H. A. Kelly, E. T. Wanderer; *Ladies:* Mrs. P. D. Oesterle, *chairman,* Mrs. R. W. Leathers, *vice-chairman; Speakers:* T. D. Jolly, R. J. S. Pigott, T. E. Purcell.

ASME Calendar of Coming Events

Sept. 8–10
ASME Fall Meeting, Hotel Schroeder, Milwaukee, Wis.
(Final date for submitting papers was May 1, 1954)

Sept. 13–24
ASME Instruments and Regulators Division and Instrument Society of America Exhibit and Joint Conference, Commercial Museum and Convention Hall, Philadelphia, Pa.
(Final date for submitting papers was May 1, 1954)

Sept. 26–29
ASME Petroleum-Mechanical Engineering Conference, Hotel Statler, Los Angeles, Calif.
(Final date for submitting papers was May 1, 1954)

Oct. 28–29
ASME-AIME Joint Fuels Conference, William Penn Hotel, Pittsburgh, Pa.
(Final date for submitting papers was June 1, 1954)

Nov. 28–Dec. 3
ASME Annual Meeting, Statler Hotel, New York, N. Y.
(Final date for submitting papers was July 1, 1954)

Feb. 16, 1955
The Founding Anniversary Meeting, McGraw-Hill Building, New York, N. Y.
(No formal papers will be presented)

March 23–24, 1955
ASME Management Conference, Hotel Statler, Cleveland, Ohio
(Final date for submitting papers—Nov. 1, 1954)

April 16, 1955
The Organization Anniversary Meeting, Stevens Institute of Technology, Hoboken, N. J.
(No formal papers will be presented)

April 18–21, 1955
Diamond Jubilee Spring Meeting, Lord Baltimore Hotel, Baltimore, Md.
(Final date for submitting papers—Dec. 1, 1954)

April 25–26, 1955
ASME Instruments and Regulators Conference, University of Michigan, Ann Arbor, Mich.
(Final date for submitting papers—Dec. 1, 1954)

June 5–10, 1955
ASME Oil and Gas Power Conference, Hotel Statler, Washington, D. C.
(Final date for submitting papers—Feb. 1, 1955)

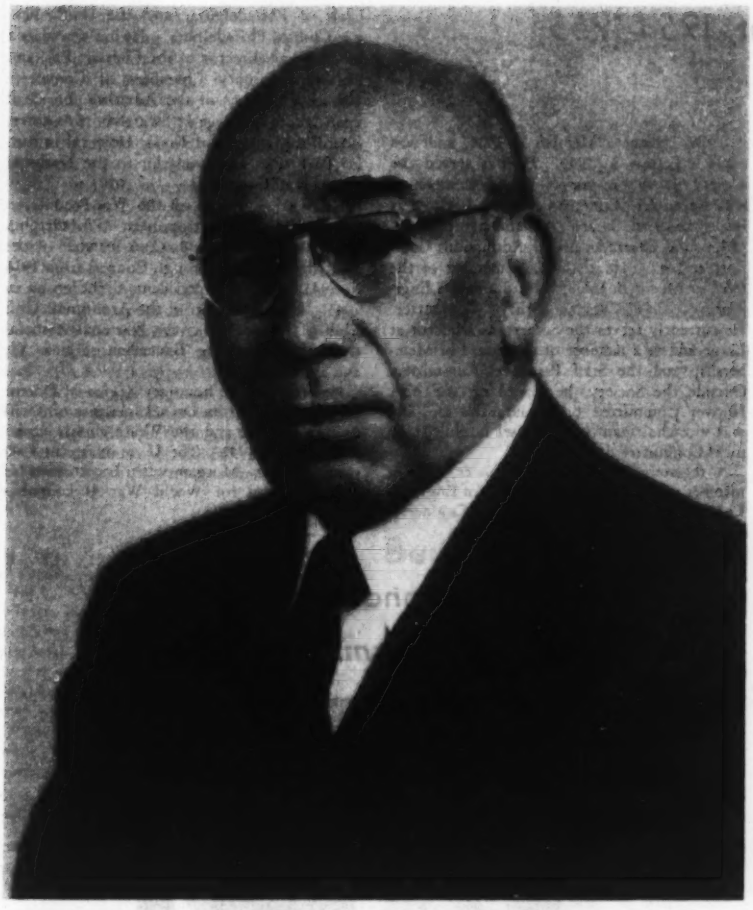
June 15–17, 1955
ASME and The Institution of Mechanical Engineers, London, England, Joint Conference on Combustion, Massachusetts Institute of Technology, Cambridge, Mass.
(Final date for submitting invited papers—Nov. 1, 1954)

June 19–23, 1955
Diamond Jubilee Semi-Annual Meeting, Hotel Statler, Boston, Mass.
(Final date for submitting papers—Feb. 1, 1955)

Sept. 12–16, 1955
ASME Instruments and Regulators Division and Instrument Society of America Exhibit and Joint Conference, Los Angeles, Calif.
(Final date for submitting papers—May 1, 1955)

Sept. 25–28, 1955
ASME-Petroleum-Mechanical Engineering Conference, Jung Hotel, New Orleans, La.
(Final date for submitting papers—May 1, 1955)

Nov. 13–18, 1955
Diamond Jubilee Annual Meeting, Hotel Congress, Chicago, Ill.
(Final date for submitting papers—July 1, 1955)



ASME OFFICERS *Nominated for* 1954-1955

David W. R. Morgan

Nominated for President

During the Semi-Annual Meeting of The American Society of Mechanical Engineers in Pittsburgh, Pa., June 20-24, 1954, David W. R. Morgan, vice-president of the Westinghouse Electric Corporation, Pittsburgh, Pa., was nominated by the National Nominating Committee for the office of President of the Society for the year 1954-1955.

Regional Vice-Presidents named by the Committee to serve for two-year terms on the Council of ASME were William H. Byrne, New York, N. Y.; J. B. Jones, Blacksburg, Va.; Ben G. Elliott, renominated, Madison, Wis.; and C. H. Shumaker, renominated, Dallas, Texas.

Directors at Large named by the Committee to serve a four-year term on the Council were George A. Hawkins, Lafayette, Ind.; Harold C. R. Carlson, New York, N. Y.; and Louis Polk, Dayton, Ohio, for one year.

Members of the Committee making the nominations were L. E. Seeley, representing Region I; P. C. Osterman, representing Region II; S. B. Sexton, 3rd representing Region III; R. C. Robertson, representing Region IV; E. W. Allardt, representing Region V; R. S. Stover, representing Region VI; S. T. Johnson, representing Region VII; and C. A. Stevens, representing Region VIII.

Election of ASME officers for 1954-1955 will be held by letter ballot for the entire membership, closing Sept. 28, 1954.

Biographical sketches of the nominees follow on the succeeding pages.

Nominated for President, 1954-1955

David W. R. Morgan

DAVID WILLIAM ROWSEN MORGAN, who has been nominated to serve for one year as President of The American Society of Mechanical Engineers, is a vice-president of the Westinghouse Electric Corporation, Pittsburgh, Pa.

Mr. Morgan, who lives in Swarthmore, Pa., has spent his entire career with Westinghouse. For eight years he was in charge of the firm's large South Philadelphia plant which manufactured steam turbines and aviation gas turbines. At present he is on the headquarters apparatus-products staff in Pittsburgh.

In the field of engineering, he is well known for his contributions in heat transfer and centrifugal and propeller-type pumps. He is also noted for his active work with high-speed diesel engines, steam turbines, and jet engines.

For 25 years Mr. Morgan was engineering director of the largest steam-condenser manufacturing activity in the United States. He was largely responsible for development of scientific tube arrangements leading to minimum steam-pressure loss and minimum condensate-temperature depression. These principles are now thoroughly established throughout the industry.

He holds more than 30 patents relating to condenser, heat exchanger, and diesel-engine apparatus.

Mr. Morgan, the son of William E. Morgan and Sarah Thomas Morgan, was born in Martins Ferry, Ohio, Sept. 16, 1892. He was graduated from Ohio Northern University in 1913 with a mechanical-engineering degree and joined Westinghouse at East Pittsburgh, Pa., that same year as a graduate student engineer.

He was assigned to test work in 1913 on one of the first geared marine-turbine propulsion units ever built. It was one year later that Westinghouse made the first installation of such equipment in a U. S. Navy ship, the collier USS *Neptune*.

Mr. Morgan became manager of the company's condenser-engineering department in 1918, moving with that department to South Philadelphia two years later. From this time until 1926 he was in charge of all engineering of surface, jet, and barometric-type condensers and all types of centrifugal pumps. From 1926 to 1934 he headed the design and construction of high-speed diesel engines.

Since 1940 the Westinghouse vice-president has held various positions in sales, engineering, and manufacturing. In the firm's Steam Division he successively held the posts of assistant manager of engineering, manager of manufacturing, works manager, assistant Division manager, and Division manager in 1945. He was appointed general manager of the Steam and Aviation Gas Turbine Divisions in 1946 and was elected vice-president in 1948. In this capacity he served as general manager of the South Philadelphia Works until August, 1953, when he was transferred to the headquarters staff of Apparatus Products in Pittsburgh.

Mr. Morgan joined The American Society of Mechanical Engineers as an Associate Member in 1916, became a Member in 1936, and was made a Fellow in 1949. He has served the Society as a vice-president and member of the Executive Committee, 1943–1945; as chairman of the Board on Membership, 1951–1952; and chairman of the Admissions Committee, 1947. He also was a member of the Hoover Medal Board of Award and the Engineering Civic Responsibility Committee. He currently serves the Society as Director at Large and as a member of the Board of Membership and the Staff Personnel Committee. Outside the Society, he served on the ASA Hoover Committee on Standardization and was vice-chairman of the Diesel Engine Technical Committee of the SAE.

A registered professional engineer, he is a member of the Newcomen Society of England, Engineers' Club of New York, Engineers' Club of Philadelphia, and the Union League Club of Philadelphia. He has served as a member and director of the Chester, Pa., and Delaware County Chambers of Commerce and as a member of the Advisory Board of Penn State College's Swarthmore Center, Board of Managers of Taylor Hospital in Ridley Park, Pa., and counselor to the National Chamber of Commerce.

He was chairman of the War-Production Committee for metropolitan Philadelphia from 1942 to 1943 and was a member of the Swarthmore, Pa., Borough Council from 1936 to 1943, serving as president of the group in 1943. He is a member of the Aronimink Golf Club of Philadelphia, the National Association of Engineering Education, Sigma XI, and Sigma Pi.

He received the honorary degree of Doctor of Engineering from Drexel Institute of Technology in 1950 and the Westinghouse Order of Merit in 1942. The U. S. Navy in 1947 presented Mr. Morgan with a certificate of commendation for World War II contributions.

Nominated for Regional Vice-President To Serve Two-Year Terms

William H. Byrne

J. B. Jones

William H. Byrne

WILLIAM HENRY BYRNE, who has been nominated from Region II to serve for two years as Regional Vice-President of The American Society of Mechanical Engineers, is president of Bryne Associates, Inc., New York, N. Y. A native of New York, he was born Aug. 11, 1900. He received his engineering training at Stevens Institute of Technology and in 1923 was graduated from Polytechnic Institute of Brooklyn with an ME degree. Mr. Byrne, in his capacity as consulting engineer, specializing in engineering services, design, and appraisal work, has been called "an engineer's engineer." He is also director and president of the firm of Stevens and Wood, Inc., which operates in the same field as Byrne Associates, Inc., but tends to specialize in power, marine, and management areas. He stepped directly into electric-utility operations on completing his training as a mechanical engineer when he was employed as assistant engineer at the Hell Gate and Sherman Creek plants of United Electric Light & Power Company—now part of Consolidated Edison Company of New York. He started in the test and efficiency department and ended up as assistant to the chief engineer of the Sherman Creek plant. This affiliation started him in the field of combustion engineering. Subsequently he continued to gain experience in power-plant design, operation, and construction with such firms as Furnace Engineering Company of New York; with Stevens and Wood; as superintendent of production with the Cuban affiliate of American & Foreign Power Company Company in Havana; and his work with Condenser Service and Engineering Company and the Hagan Corporation. In 1936 he joined the New York Public Service Commission as principal valuation engineer, a post he held until 1944. It was in that year that Mr. Byrne organized his own business. In conjunction with his consulting firm, he formed his present

principal firm, Byrne Associates, Inc., with the idea of developing the second organization into a versatile, but flexible, group capable in all facets of engineering. In 1946 he acquired Stevens and Wood, Inc., which he fashioned as a vehicle for handling engineering service contracts for government agencies and is now groomed for large-scale contracting in specialty fields. In 1949, as a result of his varied personal interests, he developed and served as director of the first Bureau of Smoke Control for the New York City Department of Housing and Buildings. He has invented a successful powdered-fuel burner and a method for closely controlling temperature in combustion chambers. He has written many technical articles on valuation and power plants. He is associated with several corporations and is a registered professional engineer in 13 states of the United States in addition to holding a National Certification of Qualification. He has been an active member of ASME since 1944 and holds membership in many other professional societies.

J. B. Jones

James Bernard Jones, who has been nominated from Region IV to serve for two years as Regional Vice-President of The American Society of Mechanical Engineers, was born in Pendleton, Va., July 11, 1900. He was graduated from the Virginia Polytechnic Institute in 1921 with a BS degree in mechanical engineering. He received the ME degree from the same institution in 1922, the MS degree from Iowa State College in September, 1924, and the MME degree from Cornell University in 1929.

Before his graduation from college, he was employed as a machinist helper in the locomotive shops of the C. & O. Railway Company. After graduation he spent two summers employed by the Engineering Experiment Station, Iowa State College.

He was a Fellow in the department of applied mechanics and experimental engineering at the Virginia Polytechnic Institute for the session 1921-1922. He was appointed instructor in the same department during the summer of 1922 and continued to serve in that department until June, 1932, having attained the rank of associate professor. In June, 1932, he was transferred to mechanical engineering as head of the department, a position he still holds, and in 1937 he was promoted to the rank of full professor.

Professor Jones became a junior member of the Society in 1923 and a member in 1935. He has served as chairman of the Virginia Section, as honorary chairman of the Virginia Polytechnic Institute student branch, and was chairman of the Student Branch Committee for Region IV. He served as chairman of the Local Sections Conference in 1941 and was secretary of the National Delegates Conference in 1942; member of National Nominating Committee in 1945 and 1947, chairman in 1947; secretary, Region IV, from 1950 to 1954.

Professor Jones is a member of Tau Beta Pi, Pi Tau Sigma, Omicron Delta Kappa, Sigma Delta Psi, and Alpha Phi Omega, honorary fraternities. He is also a member of the American Society for Engineering Education, Southwestern Virginia Engineers' Club, The Virginia Educational Association, and is past-president of the Blacksburg Lions Club. He is a registered engineer in Virginia.

Ben G. Elliott

C. H. Shumaker

Ben George Elliott

Ben George Elliott, who has been renominated from Region VI to serve for two years as Regional Vice-President of The American Society of Mechanical Engineers, was born in North Platte, Neb., on Feb. 17, 1889. He was graduated from Rose Polytechnic Institute with a BS degree in 1910 and received his MS degree in 1911. In 1913 he received a mechanical-engineering degree from the University of Wisconsin.

Before his graduation from college, he was employed as a special apprentice in the locomotive shops of Union Pacific at North Platte. After graduation he was a special apprentice in the foundry and steam-turbine departments of Allis-Chalmers Company, in Milwaukee, Wis. He later worked as a special apprentice, machinist, and road man with McKeen Motor Car Division of Union Pacific.

From 1912 to 1913 he was a Fellow in mechanical engineering at the University of Wisconsin. Then he became an instructor in mechanical engineering in the University's Extension Division. In 1915 he joined the college of engineering of the University of Nebraska as associate professor of mechanical engineering. In 1917 he rejoined the staff of the University of Wisconsin's Extension Division as associate professor of mechanical engineering and was put in charge of this department. During 1918 and 1919 he also served as a district representative of the Great Lakes District, Section on Education and Training, Emergency Fleet Corporation, U. S. Shipping Board. In 1919 he was made professor of mechanical engineering, serving both the Extension Division and the college of engineering in the development of a plan of co-operative activities between the industries of Wisconsin and the University. Since 1935 he has devoted all of his time to the college of engineering and since 1947 has been chairman of the department of mechanical engineering.

Professor Elliott became a junior member of the Society in 1911, an associate member in 1916, and a member in 1923. He is a life member of ASME and was elected a Fellow in 1952. He has served as chairman of the Rock River Valley Section of ASME, as honorary chairman of the University of Wisconsin's student branch, and was the chairman of the Student Branch Committee for Region VI. In 1942 he was chairman of the Regional Meeting at St. Louis, Mo.

He is the author of three textbooks, "The Automobile Chassis," "Automobile Power Plants," and "Automobile Repairing," and is coauthor of "The Gasoline Automobile." He has written many magazine and newspaper articles.

Professor Elliott is a member and past-national-director of the National Society of Professional Engineers; and a member; and past-member of the Council, of the American Society for Engineering Education. He is also a member of the Engineers Society of Milwaukee, the National Association of Power Engineers, and the honorary engineering societies, Sigma Tau and Pi Tau Sigma.

Clifford H. Shumaker

Clifford Harold Shumaker, who has been renominated from Region VIII to serve for two years as Regional Vice-President of The American Society of Mechanical Engineers, was born in St. Joseph, Mo., Oct. 25, 1907. He was graduated from the University of Kansas in 1930 with a BS degree in industrial engineering. In 1944 he received a professional degree of mechanical engineer from the University. In 1929 he took the Westinghouse Test Course.

His association with Southern Methodist University began in 1930 as an instructor in mechanical engineering. From 1933 to 1936 he was assistant chief draftsman with the consulting engineers' firm of Paulett and Wilson in Salina, Kan. In 1936 he returned to SMU where he has been assistant professor, associate professor, and professor of mechanical engineering. Since 1952 he has been chairman of the department of industrial engineering. In addition to his regular work on the campus he has also been director of these activities at SMU: from 1940 to 1944, the War Training Program; 1946 to date, Ordnance Gage Laboratory; since 1947, The Institute of Building Material Distribution; and since 1948, The Institute of Management.

Professor Shumaker became a junior member of ASME in 1938 and a member in 1941. He

was a member of the ASME Medals Committee in 1952. He is a member and Institutional Representative, Southwest Section of the American Society for Engineering Education, a member of the American Association of University Professors and Sigma Tau. He was a recipient of the Sigma Tau Medal and has received an ASME Certificate of Award. He is a registered professional engineer in the State of Texas.

Nominated for Director at Large To Serve Four-Year Terms

George A. Hawkins

Harold C. R. Carlson

Louis Polk

George A. Hawkins

GEORGE ANDREW HAWKINS, who has been nominated to serve as Director at Large of The American Society of Mechanical Engineers for a four-year term, was born in Denver, Colo., Dec. 11, 1907. He received his engineering training at Purdue University, being graduated in 1930 with a BS degree in mechanical engineering. Two years later he received a master's degree and in 1935 a PhD. His career in engineering education at Purdue commenced in 1930 as an assistant in applied mechanics. Two years later he was made assistant professor in mechanical engineering; subsequently he was promoted until in 1942 he was made professor. Since 1943 he has taught thermodynamics and on July 1, 1953, he was made dean of engineering and director of the Engineering Experimental Station at Purdue. In 1944 he was appointed Westinghouse research professor of heat transfer and from 1941 to 1951 he was research director of the Small Arms Division of the U. S. Army Ordnance Experimental Station. Dean Hawkins has served as visiting professor at the University of California and he spent the first three months of 1953 doing an educational and research survey in Europe. He has been a member of the Society since 1930; ten years later he was the recipient of the Pi Tau sigma gold medal. In 1945 he was given a War Department Certificate of Appreciation. With Max Jakob he was coauthor of "Elements of Heat Transfer and Insulation"; with H. L. Solberg, "Supplementary Notes on Applied Thermodynamics"; and author of "Thermodynamics."

Harold C. R. Carlson

HAROLD C. R. CARLSON, who has been nominated to serve as Delegate at Large of The American Society of Mechanical Engineers, was born in Easthampton, Mass., but has lived in New York, N. Y., for the past 25 years. After being graduated from Pratt Institute he completed additional courses at the Polytechnic Institute of Brooklyn and at Columbia University. He is a consulting engineer and heads his own firm, The Carlson Company, New York, N. Y.

He was a design engineer for the Otis Elevator Company for 12 years; chief engineer of the Lee Spring Company for five years; manager and chief engineer, The Fischer Company for two years; and has been in private practice for the past six years. His consulting practice covers industrial management, machine design, development of mechanical products, plant layout, production methods, and similar activities. He specializes to a certain extent in work for the spring manufacturing and wireforming industry and holds patents on spring coilers, spring testers, torque-testing instruments, and other products.

Mr. Carlson has long been active in the affairs of ASME and in other technical societies. He was chairman of the Metropolitan Section, 1943; chairman, Metropolitan Section Machine Design Division, from 1944 to 1950; speaker, Group Delegates Conference, 1944; Charter Member of the National Machine Devision, and was chairman of its Papers Committee, 1946; chairman, Student Talks Committee, 1949; chairman, Honors and Awards Committee, 1950 to date. He was the founder and first president of the Technical Societies Council of New York, 1946; and chairman, New York District of the American Society for Testing Materials, 1950.

He is chairman, Civil Responsibilities Committee for Region II, ASME; chairman, Engineers Division, the New York City Cancer Committee, and a director, New York Chapter, New York State Society of Professional Engineers.

He has had over a dozen technical papers printed in technical journals and is the author of the Spring Design section of the "Tool Engineers' Handbook."

Mr. Carlson is a licensed professional engineer in the State of New York; a member of Pi Tau Sigma, and is active in many civic, social, and fraternal organizations. He also has received several awards and honors for engineering services.

Louis Polk

LOUIS POLK, who has been nominated to serve as Director at Large of The American Society of Mechanical Engineers for a one-year term, is president of the Sheffield Corporation, Dayton, Ohio.

The company is engaged in producing precision measuring instruments and machine tools, gages, automatic gaging machines, threading and cutting tools, and contract manufacturing and engineering services. He is also chairman of the board of the Threadwell Tap & Die Company, Greenfield, Mass., a Sheffield-owned subsidiary, and chairman, The Sheffield Corporation of Australia Pty., Ltd., with plant and general offices at Melbourne.

His other activities include: Director of the Winters National Bank, president of Pirm, Inc., and chairman of the board of directors of the State Fidelity Federal Savings and Loan Association, all of Dayton. He is a national director and vice-president in charge of technical divisions and committees of the American Ordnance Association, as well as chairman of the Dimensional Standards and Metrology Division and a director and immediate past-president of the Cincinnati Post, A.O.A. He is president of The Sheffield Foundation, an organization which receives and distributes funds for educational, religious, scientific, and charitable purposes. Also, he is a member of the board of directors of the Salvation Army at Dayton.

In addition to the activities already described, Mr. Polk is a director and second vice-president, the National Machine Tool Builders' Associaton, a member of The American Society of Mechanical Engineers since 1943, Society of Automotive Engineers, American Society of Tool Engineers, American Gage Design Committee of the National Bureau of Standards, and a charter member of the Air Force League. He is a permanent director of the Research Fund of the American Society of Tool Engineers.

The Army Ordnance Gold Medal was presented to Mr. Polk in 1945 for "Outstanding Service." The Navy Department awarded Mr. Polk a civilian citation in 1945. That same year, Robert Patterson, Secretary of War, awarded Mr. Polk a civilian citation "for outstanding assistance rendered to the Ordnance Department in time of war."

His membership in clubs includes the Engineers, Bicycle, Moraine Country Club, Miami Valley Hunt and Polo Clubs of Dayton, Metropolitan and Deke Clubs of New York, N. Y., Queen City Club of Cincinnati, Detroit (Mich.) Athletic Club, Bloomfield Hills Country Club, Bloomfield Hills, Mich., and Union League Club of Chicago, Ill.

R. T. Sawyer, in *left photo,* presents OGP paper award to H. W. Engelman at OGP Banquet. Seated in the foreground is ASME President Sillcox; J. A. Newton and C. H. Allen, Thompson Products, Inc., *center photo,* receive OGP paper award from R. T. Sawyer; and in *right photo,* P. R. Sidler presents the 1954 Gas Turbine Power Award to R. T. Sawyer.

Program Beamed to Pipe-Line Operators Draws Large and Select Attendance to 26th Annual ASME OGP Conference and Exhibit

"Diesels Did It," the title under which Lewis K. Sillcox, ASME President, addressed the record attendance at the annual banquet of the 26th ASME Oil and Gas Power Division Conference in Kansas City, Mo., June 16, set the keynote for this the most successful of a long series of OGP conferences.

In part Mr. Sillcox said: "In 1925 the class 1 railways of the United States had a motive-power compliment of approximately 65,000 locomotives whereas today it is only one half this number with more than three fourths of locomotives being diesel-electric types. The comparatively small inventory of motive-power units now employed," said Mr. Sillcox, "is explained by the efficient use and constant availability of present-day diesel locomotives resulting in very high output per hour per unit."

Taking the principle of this theme and applying it to pipe-line operation, the four-day program presented at this conference, held at the Hotel Muehlebach, June 14 through 17, drew a record-breaking attendance of over 550, a large percentage of which was comprised of operating personnel.

Technical Papers

Treating on specific problems of the pipe-line people were technical papers on, "Foundations for Pipe-Line Compressors," by C. E. Holvenstot, Ingersoll-Rand Company; "Trends in Gas-Transmission-Compressor-Cylinder Design at Cooper-Bessemer," by W. Hartwick; "The Alleviation of Cooling-Water Problems—Use of Automatic Sulphur-Burning Equipment," by J. T. Russell, Panhandle and Eastern Pipe Line Company; also a "Report of Projects Dealing With the Deterioration of Cooling-Tower Lumber," by Donald R. Baker, The Marley Company.

Papers of more general interest included W. L. H. Doyle's "Presentation of the New Speed-Governing Specifications for Internal-Combustion Engine-Generator Units;" "Turbocharging Two-Stroke Gas Engines," by Carlton A. Chamberlain and George H. Bollman, Clark Brothers Company; also "The Sperry Engine Analyzer—A New Method of Gas-Engine Supervision," by J. E. Hart, Kaiser Aluminum & Chemical Corporation, and E. A. Sammis, Sperry Gyroscope Company.

Spirited discussions were developed in an "Operators' Panel" session and in the General Technical Committee meeting dealing with "Ignition," also a panel on "Auxiliary Drives." These panel discussions are gaining in favor and prominence in OGP programs. They bring the subject and those interested and informed on it together at a common level that promotes free and frank airing of facts and opinions.

Engineering Exhibit

The Engineering Exhibit that has always been an inherent feature of OGP conferences has become an attraction second only to the technical sessions forming the backbone of the conference. To the exhibitors goes a large measure of credit for the success of the conference.

Always timely and informative, the exhibits at this Kansas City meeting reflected great engineering strides and ever-increasing effort on the part of individual concerns to create an effect far above the ordinary. Gas turbines made their appearance among the exhibits this year. An idea of the scope of the exhibit may be gained from the following list of exhibitors and their products:

Air-Maze Corporation, Cleveland—air and oil filters, filter silencers, oil separators.

Aluminum Company of America, Cleveland—aluminum parts for diesel and gas engines.

American Air Filter Company, Inc., Louisville—cycoil oil-bath air cleaners, automatic removable media-air filter for gas turbines.

American Bosch Corporation, Springfield, Mass.—diesel fuel-injection equipment, pulse-generator low-tension ignition system.

American Locomotive Company, Schenectady—diesel engines, locomotives, heat exchangers.

Boeing Airplane Company, Seattle—gas turbines.

Burgess-Manning Company, Libertyville, Ill.—mufflers, snubber silencers.

The Cleveland Graphite Bronze Company, Cleveland—diesel and aircraft bearings, 1/4 in. to 20 in.

Commercial Filters Corporation, Melrose, Mass.—Fulflo filters and Honeycomb Filter tubes.

The DeLaval Separator Company, Poughkeepsie—unimatic centrifugal oil purifiers.

DeLaval Steam Turbine Company, Trenton—turbochargers, turbines, pumps, blowers, hydraulic drives for cooling-tower fans.

Diamond Chain & Manufacturing Company, Inc. Indianapolis—roller chains and sprockets for engine timing, auxiliary drives, flexible couplings.

Diesel Publications, Inc., New York—*Diesel Power; Motorship; Revista Diesel;* "Diesel Engineering Handbook."

Fairbanks, Morse & Company, Chicago—diesel engines and locomotives.

The Flori Pipe Company, St. Louis—precision-finished manifold weldments.

Harper Packing Company, Chester, Pa.—metal packing.

The Hilliard Corporation, Elmira—airline oil purifiers, oil reclaimers, Hyflow oil filters.

Hudson Engineering Corporation, Houston—Auto-Variable pitch fans.

Illinois Testing Laboratories, Inc., Chicago—"Alnor" pyrometers; air-velocity measuring instruments.

Johnson Bronze Company, New Castle, Pa.—diesel-engine bearings; power-metallurgy parts.

Koppers Company, Inc., Baltimore—American Hammered piston rings, Aeromaster Fans, Fast's Couplings.

Lubaid Company, Milwaukee—Lubaid-D diesel fuel-oil treatment, liquid sootout.

The Marley Company, Kansas City—cooling towers.

Massey Machine Company, Watertown, N. Y.—hydraulic isochronous governors, speed-pressure governors, centrifugal and overspeed governors.

Miehle-Dexter Supercharger Division, Racine—Superchargers.

National Supply Company, Toledo—power-transmitting torque converters.

Nordberg Manufacturing Company, Milwaukee—diesel engines.

William W. Nugent & Co., Inc., Chicago—oil filters and strainers, sight-feed valves, sight-flow indicators, multiple oilers, compression-union fittings.

Read Standard Corporation, New York—Standardaire blowers.

Robertshaw-Fulton Controls Company, Knoxville—diesel-engine safety and cooling-water controls, packless valves, temperature and pressure regulators.

Schweitzer-Cummins Company, Indianapolis—turbochargers, superchargers, torsional vibration dampers, pumps, starting motors, fan drives.

Scintilla Division, Bendix Aviation Corp., Sidney, N. Y.—diesel fuel-injection equipment, low-tension and high-tension ignition equipment.

Solar Aircraft Company, San Diego—gas turbines.

U. S. Hoffman Machinery Corporation, New York and Syracuse—Vacu-matic oil filter.

Van der Horst Corporation of America, Olean, N. Y.—Porus-Krome plating, Vanderloy(iron electroplating).

Van Norman Company, Springfield, Mass.—crankshaft grinder, 42 in. × 180 in.

Warner Lewis Company, Tulsa—water separators and oil filters.

Wilkening Manufacturing Co., Philadelphia—Pedrick piston rings.

Witte Engine Works, Kansas City—Series 100 diesel engine.
Woodward Governor Company, Rockford, Ill., —engine governors; isobaric pressure regulator.

1955 OGP Conference in Washington

Locale of the 1955 OGP Conference will be Washington, D. C. The theme is to be "Oil and Gas Power for National Defense." A high government official will deliver the banquet address. In general, the 1955 Conference is being planned to bring the Diesel and Gas-Engine Industry into sharp focus on a national plane. John A. Worthington, Koppers Company, Baltimore, Md., is OGP Chairman for the 1954-1955 fiscal year.

Availability List for 1954 ASME Oil and Gas Power Conference Papers

The papers in this list are available in separate copy form until April 1, 1955. Please order only by paper *number;* otherwise the order will be returned. Copies of these papers may be obtained from the ASME Order Department, 29 West 39th Street, New York 18, N. Y.

Paper No.	*Title and Author*
54—OGP-1	Trends in Gas-Transmission-Compressor-Cylinder Design at Cooper-Bessemer, by W. Hartwick
54—OGP-2	The Sperry Engine Analyzer—A New Method of Gas-Engine Supervision, by J. E. Hart and E. A. Sammis
54—OGP-3	The Alleviation of Cooling-Water Problems—Use of Automatic Sulphur-Burning Equipment, by J. T. Russell
54—OGP-4	A Summary Report of Projects Dealing With the Deterioration of Cooling-Tower Lumber, by D. R. Baker
54—OGP-5	Foundations for Pipe-Line Compressors, by C. E. Holvenstot and S. G. Hagerman
54—OGP-6	Presenting the New AIEE-ASME Speed-Governing Specifications for Internal-Combustion Engine-Generator Units, by W. L. H. Doyle
54—OGP-7	Turbocharging Two-Stroke Gas Engines, by C. A. Chamberlain and G. H. Bollman

New Flexibility Section, ASA Code for Pressure Piping, Now Available

In April, 1951, Chairman F. S. G. Williams of ASA B31 Sectional Committee on Code for Pressure Piping appointed two Task Forces to investigate two problems of primary importance in the field of Pressure Piping.

The first of these Task Forces, headed by D. G. Reid, was established for the purpose of resolving differences in point of view concerning criteria to be used in calculating the wall thicknesses of high-pressure high-temperature piping. After considerable study and discussion, this Task Force recommended a modified formula for pipe wall thickness which was adopted by the ASME Boiler Code Committee as well as for Sections of the ASA B31 Piping Code to which it is applicable. The recommendations of the Task Force are ably presented in a paper by W. R. Burrows, R. Michel, and A. W. Rankin, appearing in the Transactions of the ASME for April, 1954, vol. 76, no. 3.

The new formula is based on sound technical and practical reasoning and was agreed upon only after a thorough study of not less than 31 different formulas. Real progress has been accomplished and all members of this Task Force deserve the appreciation of industry for the labors which brought about this result.

At about the same time, i.e., in April, 1951, a second Task Force was appointed to formulate new rules governing the subject of Expansion and Flexibility. While the ASA B31.1-1951 Code did cover the subject in a way, the requirements had been found inadequate as the industry developed and, therefore, revision seemed desirable. A second Task Force was therefore appointed by Mr. Williams under the chairmanship of Sabin Crocker, with Henry C. E. Meyer as vice-chairman and S. W. Spielvogel as secretary. It was appreciated from the outset that the Expansion and Flexibility Task Force would be confronted with a formidable problem since it did not have access to such vast experience and theoretical historical background as was available in the study of the formula for pipe thicknesses. Furthermore, the combination of stresses in piping systems as designed and installed and the criteria for failure are more involved and not so susceptible to verification by test.

The work was divided between two Subgroups as follows:

Subgroup No. 1 on Stresses and Reactions —H. C. E. Meyer, *chairman* (Gibbs & Cox, Inc.); S. W. Spielvogel, *secretary* (Consolidated Edison Company); Norman Blair (Bechtel Corporation), J. D. Conrad (Westinghouse Electric Corporation), Arthur Edwards (Stone & Webster Engineering Corp.), John W. Heck (American Bureau of Shipping), Arthur McCutchan (Tube Turns, Inc.), A. R. C. Markl (Tube Turns, Inc.), Rudolph Michel (Bureau of Ships, Navy Department), A. W. Rankin (General Electric Company), H. V. Wallstrom (M. W. Kellogg Company), R. A Smyth (Captain, U. S. Coast Guard).

Subgroup No. 2 on Coefficients and Expansion and Physical Constants—Rudolph Michel, *chairman* (Bureau of Ships, Navy Department), E. C. Chapman (Combustion Engineering, Inc.), J. D. Conrad (Westinghouse Electric Corporation), J. E. Lattan (Taylor Forge & Pipe Works), Arthur McCutchan (Tube Turns, Inc.), G. Sinding-Larsen (Pittsburgh Piping & Equipment Company), S. W. Spielvogel (Consolidated Edison Company), H. V. Wallstrom (M. W. Kellogg Company).

Both Subgroups started their respective tasks as promptly as possible. By 1952 Subgroup 2 had developed a great mass of data on the physical characteristics of various materials. Subgroup 1 had in the meanwhile established a new approach to the evaluation of the expansion stresses by introducing the concept of stress range which conforms more rationally to the actual behavior of piping at elevated temperature than the previous limitation of an allowable combined stress. It was also considered advisable to provide tables of elastic constants and expansion coefficients. Stress-range reduction factors for cyclic conditions, stress-intensification and flexibility factors were also considered, it being understood that the data given were based on present knowledge and that if and when better information was available as the result of experience or test, such data could be applied.

It soon became apparent that the accumulated information could hardly be correlated and embodied in a satisfactory text through discussions in a large group. Chairman Meyer of Subgroup 1, therefore, appointed a working group to prepare a preliminary draft which could be a basis for discussion by the Subgroup as a whole. This working group consisted of S. W. Spielvogel, A. R. C. Markl, H. V. Wallstrom, and Norman Blair.

The preliminary text developed by the working group was revised to meet the views of the entire membership of the Subgroup with the result that an amended text was presented to the Executive Committee in April, 1953, and approved for submission to industry for review. Notices were published in the June, 1953, issue of Mechanical Engineering stating that copies of what was designated the May 1, 1953, Report were available to those interested in the subject. Six-hundred copies of this report were distributed.

At the 1953 Annual Meeting of the ASME, Paper No. 53—A-51 by A. R. C. Markl and Paper No. 53—A-52 by Rudolph Michel were presented to expound thoroughly the reasoning behind the work of the respective subgroups. The comments on these papers and on the May 1, 1953, Report had become so voluminous by early 1954 that in order to expedite the work, Chairman Meyer of Subgroup 1 again called on a special group to assist him in analyzing the various comments. This group consisted of S. W. Spielvogel, H. V. Wallstrom, and O. Nielsen (nonmember, of Gibbs & Cox, Inc.).

The various comments were condensed into a single report which was sent to all members of Subgroups 1 and 2. The text was revised by Subgroup 1 members to meet as far as practicable the constructive suggestions submitted by industry and any further comments by the members of the Subgroup as a whole. A revised text submitted to the Executive Committee in March, 1954, was accepted for publication, subject to such editing as might be needed and including the tables of physical constants and expansion values produced by Subgroup 2.

Some of the letters received during April, 1954, brought out the point that for low operating temperatures the permissible stresses could become quite high. After consideration

by a working subcommittee, this problem was presented to Subgroup 1 and a consensus reached that the formulas as proposed are essentially satisfactory and that only minor editorial clarification is required. This amplification has been incorporated in the present report as presented under date of June 21, 1954.

The following explanatory remarks explain why this action was agreed upon:

"It must be recognized that, while the formula for S_A determines the allowable stress range, the maximum combined stress may reach a value of 2.5 S_c where the temperature is 650 F and below for power piping or for oil piping up to 100 F.

However, it is further true that the attainment of these high stress values can only occur in very stiff piping in the cold condition with 100 per cent cold pull-up or in the hot condition with zero cold pull-up and when E_c and E_h are substantially equal. Where such high stresses exist, the major part of the stress is flexure stress due to expansion and is therefore extremely local and these locally high stresses may result in a slight deformation which, however, is not anywhere as severe as occurs in bending a pipe cold. Therefore these highly localized stresses should not result in failure of the pipe."

The ASME has now available copies of this report dated June 21, 1954, including tables. Copies can be obtained free of charge upon request to the ASME offices, 29 West 39th Street, New York 18, N. Y., by asking for "New Flexibility Section, ASA Code for Pressure Piping." The revised text has been authorized for use until such time as a new edition of the ASA Code can be published through Case 13 (Reopened) which now reads as follows:

CASE 13 (REOPENED)

Inquiry. What is the status of the "Report of the Task Force on Flexibility, June 21, 1954," as it relates to the previous report of May 4, 1953, and Paragraph 620 in the 1951 Edition of the Code for Pressure Piping?

Reply. It is the opinion of the Committee that in view of the June 21, 1954, report being the final opinion of the Task Force on Flexibility, that until the new 1955 Edition of the Code for Pressure Piping is published revising Paragraph 620, the June 21, 1954, report should be used in designing any new projects. For designs already completed and those in progress any one of the following procedures will meet the intent of the Code as it applies to piping flexibility:

(*A*) Follow the wording of Paragraph 620 of the ASA B31.1–1951 Code.

(*B*) Follow the proposed revised wording given in the "Report of Task Force on Flexibility, May 4, 1953."

(*C*) Follow the proposed wording in the May 4, 1953, Task Force Report, except using the alternate paragraphs contained in the report.

(*D*) Follow the June 21, 1954, Report.

The revised Chapter 3 as given in the June 21, 1954, report is now considered ready for application and no further changes are contemplated until, as the result of its having been in force for some years, it is found to be necessary to make modifications.

21st Power Show Advisory Committee Announced

ORGANIZATION of the Advisory Committee for the 21st National Power Show has been completed under the continued chairmanship of I. E. Moultrop, consulting engineer, of Boston, Mass. As previously announced, the show, officially known as the 21st National Exposition of Power and Mechanical Engineering, will be held at the Commercial Museum in Philadelphia, Pa., Dec. 2 to 7, under the auspices of The American Society of Mechanical Engineers. Reservations already made indicate that the display in Philadelphia will equal in number of exhibits the last show of the series, which was held in New York, N. Y., two years ago.

John H. Lawrence again serves as vice-chairman of the Committee. Others continuing on the Committee are: Chester R. Earle, managing editor, *Power Engineering*; Kilshaw M. Irwin, vice-president in charge of engineering, Philadelphia Electric Company; George A. Orrok, Boston Edison Company; Joseph Pope, vice-president, Stone & Webster Engineering Corporation; C. J. Sibler, chief engineer, West Virginia Pulp & Paper Company; A. Bowman Snavely, chief engineer, Hershey Chocolate Corporation; and Philip W. Swain, editor, *Power*.

Members newly appointed to the Committee this year include: M. J. Goglia, professor, school of mechanical engineering, Georgia Institute of Technology; Arthur J. Hess, president, American Society of Refrigerating Engineers: L. N. Hunter, president, American Society of Heating and Ventilating Engineers; and C. E. Morrow, engineer, Power and Service Facilities Engineering, Western Electric Company.

Representing The American Society of Mechanical Engineers on the Committee are: Lewis K. Sillcox, president, hon. vice-chairman of the board, New York Air Brake Company; A. C. Pasini, director, The Detroit Edison Company; T. R. Olive, chairman, Board on Technology, McGraw-Hill Publishing Company; J. Keith Louden, chairman, Meetings Committee, York Corporation; and C. E. Davies, secretary.

As heretofore, the exposition will be under the management of the International Exposition Company, with headquarters at 480 Lexington Avenue, New York 17, N. Y.

Actions of the ASME Council at a Meeting Held in Pittsburgh, Pa., June 20-21

THE Council of The American Society of Mechanical Engineers met in four sessions at the William Penn Hotel, Pittsburgh, Pa., during the 1954 Semi-Annual Meeting. The following were present at one or more of the sessions: L. K. Sillcox, president; F. S. Blackall, jr., J. Calvin Brown, J. D. Cunningham, E. W. O'Brien, and A. D. Bailey, past-presidents; Thompson Chandler, Ben G. Elliott, H. R. Kessler, W. G. McLean, V. A. Peterson, C. H. Shumaker, W. F. Thompson, and P. R. Yopp, vice-presidents; F. L. Bradley, L. J. Cucullu, R. L. Goetzenberger, R. B. Lea, H. E. Martin, D. W. R. Morgan, A. C. Pasini, and Louis Polk, directors at large; C. E. Davies, secretary; E. J. Kates, assistant treasurer; O. B. Schier, 2nd, assistant secretary; Ernest Hartford, deputy secretary; and T. A. Marshall, Jr., administrative assistant; L. C. Smith, Constitution and By-Laws Committee; Warner Seely, Board on Honors; J. H. Harlow, Board on Membership; T. R. Olive, Board on Technology; Joseph Pope, Finance Committee; B. G. Dick, T. N. Graser, and R. C. Robertson, Nominating Committee; V. W. Smith, T. E. Purcell, Organization Committee; Charles Kurcina, E. L. O'Donnell, John Harder, and C. N. Tyler, Jr., junior observers; C. W. Crawford, D. A. Fisher, A. B. Heiberg, J. P. Heumann, D. A. Holdén, A. H. Jensen, R. L. Johnson, G. M. Ketchum, J. W. Little, P. T. Onderdonk, F. L. Schwartz, A. K. Simons, W. H. Swann, R. D. Teece, R. W. Worley, Delegates; and L. S. Whitson, chairman, RDC Agenda Committee; L. E. Herbert, F. W. Miller, J. T. Rettaliata, R. A. Sherman, H. H. Snelling, and E. S. Theiss, guests.

At the start of the Council meeting on June 21, John L. Young, vice-president, United States Steel Corporation, addressed the Council, explaining the plans for developing Pittsburgh and extending an invitation to the engineering societies to locate their headquarters in Pittsburgh.

Membership Applications

The Council voted that all applications for membership and transfer to Associate Member grade must be approved by the Section Executive Committee and Vice-President of the Region from which the application originates.

Specialized Interests

It was reported that the Organization Committee during the past six months has been studying the problem of Council reorganization. At a recent meeting the Committee requested the Board on Technology to study the problems relating to a better development of the special interests of the membership and to make suitable recommendations.

Council Reorganization

At the request of the Council, the Organization Committee and the Constitution and By-Laws Committee prepared a report on reorganization of the Council to permit specific representation on the Council of leaders in Professional Divisions, and Research, Standards and Codes, and the Administrative activities of the Society. The report also suggests provision for an increase in the Nominating Committee so that the representa-

tives of these activities could be presented to the Nominating Committee by members of their own choosing.

The Council approved the report of the two Committees on reorganization of the Council, voted to endorse the changes in the Constitution necessitated by the reorganization of the Council, and to submit the proposed amendments to the Business Meeting. It also voted to receive for first reading proposed amendments to the By-Laws affected by constitutional changes to be made in connection with the reorganization of Council. (This subject was brought up and discussed at the business meeting on June 21, 1954, in Pittsburgh, Pa., and the actions taken at that meeting appear in the ASME News on page 707.)

Reciprocal Membership

It was voted to endorse a change in Article C5, Sec. 4 (Fees and Dues) of the Constitution and to receive for first reading proposed amendments to the By-Laws which relate to exemption from paying initiation or entrance fees by any member of the American Institute of Electrical Engineers who applies for membership in ASME.

Honorary Members

The following men were elected Honorary Members of the Society: Luis Giannattasio, Montevideo, Uruguay; George L. Sullivan, Santa Clara, Calif.; Henry B. Oatley, New York, N. Y.; Charles Erwin Wilson, Washington, D. C.; and Abbott L. Penniman, Jr., Baltimore, Md.

The Council approved awarding Honorary Membership to Dr. Giannattasio during the UPADI meeting in São Paulo, Brazil, Aug. 2–10, 1954; and to Secretary of Defense Charles E. Wilson during the Spring Meeting of the ASME in Baltimore, April 18–21, 1955.

1954 ASME Awards

The following awards and honors were approved for 1954:

ASME Medal to Edwin B. Powell, Fellow ASME, Boston, Mass.;

George Westinghouse Gold Medal to Walker L. Cisler, Fellow ASME, Detroit, Mich.;

Holley Medal to Walter A. Shewhart, Murray Hill, N. J.;

Worcester Reed Warner Medal to Joseph H. Keenan, Fellow ASME, Cambridge, Mass.;

Spirit of St. Louis Medal to Arthur Emmons Raymond, Santa Monica, Calif.;

Melville Medal to Edmund Q. Sylvester, Mem. ASME, Chicago, Ill., for his paper, "Pressure-Pouring Steel Car Wheels in Permanent Molds";

Richards Memorial Award to Robert Holmes Hughes, Assoc. Mem. ASME, Dante, Va.;

Pi Tau Sigma Gold Medal Award to Emmett Elbert Day, Mem. ASME, Seattle, Wash.

Charles T. Main Topic

"The Atom and the Mechanical Engineer" was approved as the Charles T. Main topic for 1955.

Nuclear Engineering

The importance of surveying ASME members who are engaged in nuclear-engineering activities was discussed by the Nuclear Energy Application Committee and the Board on Technology. Upon their recommendation it was voted to adopt proposed recommendations on nuclear-engineering activity and to authorize John R. Dunning to represent the President at a meeting in Ann Arbor, Mich., June 21, 1954, to discuss the organization of engineering activities in the nuclear-engineering field.

New Research Committee

The establishment of a Research Committee on Engineering Administration was authorized to study the problems of the administration of engineering in order to develop methods for the training of engineers and engineering students in such administration. Funds were authorized for the project.

Engineering Education and Training

A second conference on engineering education is to be held by EUSEC (Conference of Engineering Societies of Western Europe and the United States) in Zurich, Switzerland, September, 1954. The five American societies, including the ASME, who are member bodies of EUSEC have adopted the uniform policy of requesting ECPD to act for them on educational questions being discussed.

At Zurich there will be a discussion of the proposed International Association for Engineering Education and Training, the membership of which will consist of Foundation Members, Corporate Members, Associates, and individual members. The Executive Committee of ECPD on June 2, 1954, voted that the ECPD (American) delegation be instructed to insist that any constitution for the proposed Association provide that either ECPD or ASEE shall enjoy such form of membership as to enable them to be on the governing board.

The ASME Council voted that ECPD should be recognized as the U. S. A. member of the proposed Association and that the Secretary so inform other members of EUSEC.

Section Changes

It was voted to remove Miller County, Ark., from the North Texas Section as that county was assigned to the Shreveport Group of the Mid-Continent Section in 1953.

Establishment of Sabine Section with headquarters at Beaumont, Texas, was voted. The territories will include counties in Texas (formerly of the South Texas Section), Newton, Jasper, Chambers, Jefferson, Orange, Hardin, and Tyler; and parishes in Louisiana (formerly of the New Orleans Section), Calcasieu, Cameron, Beauregard, and Vernon.

Survey on Employment Conditions

In the fall of 1953, as a measure of cooperation with Engineers Joint Council, the Society conducted a survey of the membership to secure opinions on employment conditions. The following statement of the results of this questionnaire was adopted: "In the fall of 1953, members of the Society in the United States were asked, as a co-operative fact-finding effort with our sister engineering societies, to express their opinion about unionization of engineers. The results show overwhelming national opposition to the idea. The facts have been reported to the co-operating groups accordingly."

Applied Mechanics Reviews

Extension of the Agreement with Midwest Research Institute for the preparation of material for the *Applied Mechanics Reviews* was voted to the end of the current calendar year, Dec. 31, 1954.

Resolution of Thanks

A resolution of thanks was adopted in connection with the Semi-Annual Meeting in Pittsburgh, Pa., June 21–24, 1954, expressing the appreciation of the Society to all who contributed to the success of the Meeting.

Certificates of Award

The following retiring chairmen of Sections were granted certificates of Award: Charles M. Merrick, Anthracite-Lehigh Valley; James N. Landis, San Francisco; and Frank P. Baeyertz, Southern California.

A certificate of award was also granted to Douglas W. Bennett who served as chairman of the Virginia Section from 1950 to 1951.

New Engineering Societies Building

The Secretary reported that the five societies concerned had approved Resolutions of Intent to work out the problem of a new engineering center co-operatively. These societies are: The American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, The American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the American Institute of Chemical Engineers. The societies have agreed on the appointment of a Committee of Five Presidents, the chairman of which has not yet been selected.

The Real Estate Committee of United Engineering Trustees, Inc., has established a working committee to develop facts essential to the solution of the general problem of selecting a suitable location for engineering societies headquarters.

EJC Constitution Changes

The Council considered and approved proposed changes in the Constitution of Engineers Joint Council which will involve the addition of enabling clauses to permit the election of associates, the admission of affiliates, and individual members to EJC.

IEC Jubilee Meeting

Payment of $200 was authorized from the

money set aside for International Standards' activity toward the support of the International Electrotechnical Commission Jubilee meeting in September, 1954.

Philippine Association of Mechanical and Electrical Engineers

The secretary reported that John T. Naylor, vice-president of The Philippine Association of Mechanical and Electrical Engineers, Manila, personally conveyed to ASME the greetings and best wishes of his Association. The President was requested to extend the greetings of ASME to the Philippine Association.

Fred V. Larkin

The death of Fred V. Larkin on May 23, 1954, was noted with regret. Mr. Larkin served as Manager of the Society in 1943 and was for many years an active committeeman.

Regional Delegates Conference

Recommendations of the 1954 Regional Delegates Conference were presented to the Council on June 21, 1954. Sincere appreciation and thanks were voted to the Regional Delegates for their work. It was voted to receive the report and to refer the recommendations to the Committees concerned for report to the Council.

Presidential Appointments

The following presidential appointments were confirmed:

Parkin T. Sowden to EUSEC and UPADI Conference, Brussels, Belgium, June 11–12, 1954.

George L. Sullivan to San Francisco State College dedication of new campus, Oct. 16, 1954.

1954 ASME Semi-Annual Business Meeting Report

The Semi-Annual Business Meeting of The American Society of Mechanical Engineers was held on June 21, 1954, in the ballroom of the William Penn Hotel, Pittsburgh, Pa., in conjunction with the Society's 1954 Semi-Annual Meeting.

President Sillcox opened the meeting with an announcement that the 1955 Semi-Annual Meeting has been scheduled for June 19–23, 1955, at the Hotel Statler, Boston, Mass. President Sillcox then read the names of the nominees for the 1955 National Nominating Committee, who were unanimously elected. He also announced the results of a letter ballot taken on the Engineering Center which asked: "Do you approve vesting in the Council the authority to decide for The American Society of Mechanical Engineers at such time and place and in such manner as the Council may elect, such changes, if any, in Society headquarters location as the Council may deem to be in the best interest of the Society and in keeping with its dignity and tradition?" Polled on April 26, a total ballot of 17,418 was cast; of which 17,218 were valid and of the valid ballots 16,279 were affirmative and 939 negative.

The main order of business was the presenting of three amendments to the Constitution which the Business Meeting voted to submit to a letter ballot. The three amendments relate to Article C5, Section 4, which permits Council to remit initiation fees as well as dues; Article C6, Section 2, relating to the composition of Council; and Article C7, Section 4, dealing with the election of officers and directors, and whatever changes in the By-Laws that will be necessitated.

The Business Meeting voted to canvass by letter ballot member opinion on the proposed changes in the method of selection of the Nominating Committee.

Over 5000 Questionnaires Returned in First Three Days

Please send in your Membership Survey Questionnaire if you have not already done so.

The Secretary's Office reports that even though the response has been excellent, the success of the project depends on *all* members participating in it.

Those members who may question the inclusion of the coded material on the back of the Questionnaire should know that it will be used to tabulate the replies by Section and grade of membership and that it does not permit personal identification of the member.

Junior Forum . . .

Conducted by Joseph Schmerler, Assoc. Mem. ASME

HELP WANTED: Engineer, 35, nine years' experience, who has worked for his present employer, a large manufacturing company, for the past six years. Work will be mostly in office, field work occasionally, and he will supervise five other persons. He should not be an adventurous type but want to stay with the firm. He should like his work but may be inclined to be unhappy with his salary. Will not know quite how he stands with the company and may feel that more effective use can be made of his training and abilities. Only a part of his working day will be devoted to purely engineering tasks. Must not expect to get the amount of professional recognition he deserves.

This is the description of the typical engineer as taken from a survey of more than 1300 engineers who work for over 200 companies ranging from small two-man shops to the great corporations. The survey was conducted for a report on "How to Attract and Hold Engineering Talent" issued by the Professional Engineers' Conference Board for Industry.

Contained in the report along with executive-engineers' opinions about their job and profession are those expressions of the employee-engineers regarding these subjects. Since the employee questionnaires were not signed or marked the opinions expressed represent a fairly good cross section of the thoughts of this group.

Americans, and engineers especially, love to indulge in surveys. With that in mind, Junior Forum is presenting the results of the Professional Engineers' Conference Board for Industry report on various questions asked of the employee-engineers.

On the question of whether or not the schools have adequately prepared their graduates, 28 per cent of the replying engineers indicated a feeling that there was need for more work in English, the social sciences, and business administration. The importance of this feeling of lack of adequate preparation, as a factor in the employee's subsequent adjustment, is emphasized by the fact that 90 per cent of those who expressed this opinion also indicated that they were dissatisfied with the prospects for advancement in their present place of employment. In all, 34 per cent of the engineers responding indicated that they were not satisfied in this respect where they now work.

Coupled with this lack in individual preparation, there is exhibited an apathy in company encouragement of professional activities on the part of its employees. While approximately 40 per cent of the firms represented encourage participation in professional-society activities, and grant reasonable time off, without loss of pay for such participation, other "prestige" activities such as writing for technical publications, teaching, or lecturing on engineering subjects, and participation in community affairs receive relatively minor encouragement from management.

About one fourth of the firms encourage participation in community affairs, only 16 per cent feel it advantageous to have their engineers write for publications, and less than 11 per cent encourage teaching or lecturing on the part of their professional men.

In the spring of 1953 staff recruiters from companies large and small vied with each other to such an extent in the rush to grab the graduating engineers that starting salaries were the highest ever offered a fledgling engineer—well over $350 a month, in most cases. Many companies offered transportation and "expenses" for trips to their plants, hundreds of miles away, for interviews. These high-pressure junkets, glowing "help-wanted" ads, and other recruiting inducements got results in most cases but the benefits have been proved to be short-lived.

To the question: "Was your first job actually as it was described to you at the time you accepted employment?" 20 per cent answered "No." Most of the members of this group were young men who entered the profession

during the labor shortage of the past few years. Even more significantly, nearly all those who answered "No" are today unhappy in in their jobs. Many of them, after months of routine work on a drafting board, in testing, in analysis, or on computing assignments, are bored and do not feel that the companies are making use of their talents for which there was such frantic bidding only a few months before. Their companies face the potential added expense of training new replacements for them.

To other questions in this line: "Do you feel that your company recognizes your professional status?" 29 per cent answered "No."

"Do you feel that your company is making effective use of your training and ability?" 38 per cent answered "No." "Are you satisfied with your job with respect to the factors of salary, prospects, nature of work, working conditions, or location of work?" 38.6 per cent answered "No."

Each of these "No" groups included most of those who thought that they had been oversold on their jobs.

So far as benefits and incentives play a part in inducing an engineer to take a job, it would seem that security is of major concern. Forty-two per cent of those questioned said that they would not accept a higher-paying job, with more responsibility, if they were not assured the same security of employment as exists in their current job. This does not necessarily mean that these people are content in their present employment because 68 per cent of the respondents indicated that they were seeking other positions within the firms where they are employed, and 78 per cent said that they plan eventually to shift to fields other than those in which they are now engaged.

Finally, 55 per cent of the questionaire returns showed that employers offered job security, and 54 per cent offered opportunities for advancement. Only 32 per cent of the companies had training programs while 30 per cent had profit-sharing or stock-bonus plans. Six per cent offered some other inducement.

With security and salary of such major concern to the employee-engineer, what then was the answer to the question: "Do you believe engineers' interests are strengthened economically or otherwise by membership in a collective-bargaining organization?" Thirty-four per cent of them answered affirmatively.

Nor were these affirmative voters simply malcontents. Represented in this group were approximately the same proportion of contented and discontented employee-engineers.

Significantly though, the opinion voiced by this group was formed by most of its members without any actual experience with a labor organization. Only about six per cent of the total number of 1300 engineers questioned were employed in plants which have collective-bargaining organizations for their professional employees. Of that relatively small number, only half belong to the union.

Sixty-eight per cent of the returns reflected the view that unionization was wholly inconsistent with professionalism by indicating their emphatic disapproval with points and penciled comments on their questionnaire.

When it came to the question of nonbargaining organizations, however, 66 per cent of the respondents said they favor such an organization within the company "for the purpose of establishing a medium for interchange of ideas and improving communications with management."

Several among the 34 per cent who voted "No" explained their negative opinions with the assertion that "all too often" such nonbargaining organizations can be swung into the union fold by a small but active minority of prounion sympathizers.

Approximately ten per cent of those surveyed work in plants where the engineers have a nonbargaining organization. About 80 per cent of that group belong to their company organizations.

The idea of encouraging nonbargaining, intraplant organizations for engineers also might be explored as a potentially beneficial move, not only from the standpoint of giving the engineers a vehicle of expression and a center for the interchange of ideas but also as a valuable channel of communication.

Engineering Societies Personnel Service, Inc.

THESE items are from information furnished by the Engineering Societies Personnel Service, Inc., in co-operation with the national societies of Civil, Electrical, Mechanical, and Mining and Metallurgical Engineers. This Service is available to all engineers, members, or nonmembers and is operated on a nonprofit basis.

In applying for positions advertised by the Service, the applicant agrees, if actually placed in a position through the Service as a result of an advertisement, to pay a placement fee in accordance with the rates as listed by the Service. These rates have been established in order to maintain an efficient nonprofit personnel service and are available upon request. This also applies to registrant members whose availability notices appear in these columns. Apply by letter, addressed to the key number indicated, and mail to the New York office.

When making application for a position include six cents in stamps for forwarding application to the employer and for returning when necessary. A weekly bulletin of engineering positions open is available at a subscription of $3.50 per quarter or $12 per annum for members, $4.50 per quarter for nonmembers, payable in advance.

New York
8 West 40th St.

Chicago
84 East Randolph St.

Detroit
100 Farnsworth Ave.

San Francisco
57 Post St.

Men Available[1]

Mechanical Engineer, 39; married; paper-converting experience; seven years of responsible supervision in design engineering in aforementioned industry; eight years automatic machine designing in varied fields. Desires supervisory position in engineering department. Prefers Northeast. Me-106.

Design and Development Engineer, BSME; 26 years' varied experience with du Pont, Midwest Piping, Mueller Brass, Hydropress, Bullard, Remington Rand, Medart, and Bendix. Developed 43 patents. Me-107.

Mechanical, Chemical Engineer, BME; 35; ten years steam, diesel, manufactured, natural gas; one and half years' chemical-manufacturing experience; author of technical papers. Desires staff engineering position with utility, manufacturing, consulting. Prefers East. Me-108.

Mechanical-Industrial Engineer, 32, BSME; BA in chemistry; executive background and experienced in plant engineering and layout, materials handling, cost reduction, quality control, standards, manufacturing methods, equipment design, and technical writing. Me-109.

Positions Available

Project Engineer, 30–45, ME degree; five years' experience covering product development and design projects involving problems in mechanics and hydraulics; rolling, welding, forming, and forging of medium-to-heavy steel and alloy metals, including tooling requirements. $6000–$9000. Western Pa. W-22.

Project Engineer, young, graduate mechanical engineer, good knowledge of metallurgy, to assist chief engineer on projects which will include metallurgical problems, development of new products, and shop-inspection procedures for company manufacturing forged-steel fittings. $6000 to start. Northern N. J. W-33.

Industrial Engineer, graduate, industrial, or mechanical engineer; 26–30; three to five years as assistant industrial engineer with some supervisory duties in the heavy-manufacturing field. $6000–$7000. Upper New England. W-55.

Instructor or Assistant Professor of Mechanical Engineering, MS desired; with leanings toward heat power, heating, ventilating, and air conditioning; or internal-combustion engines. To $4500 for ten-month contract period, depending on qualifications. North Central State. W-58(*b*).

Noise and Acoustics Engineer, 28–35, prefer MS in physics, but will accept MS in electrical or mechanical engineering; three to five years' engineering experience in industrial equipment, noise control, and architectural acoustics. To provide consulting services on noise and acoustical problems in industrial plants. Salary commensurate with experience. Del. W-77.

Associate Professor or Professor, under 50; at least MS in mechanical engineering, to teach hydraulics, mechanics, thermodynamics, power, and supervise laboratory courses. $6000–$7000 for eleven months. Pakistan; two-year contract. F-86.

Mechanical Engineer, about 35, experience in pulp and paper mills, to supervise design installation of paper-mill machinery and equipment. $10,000–$12,000. South America. F-115.

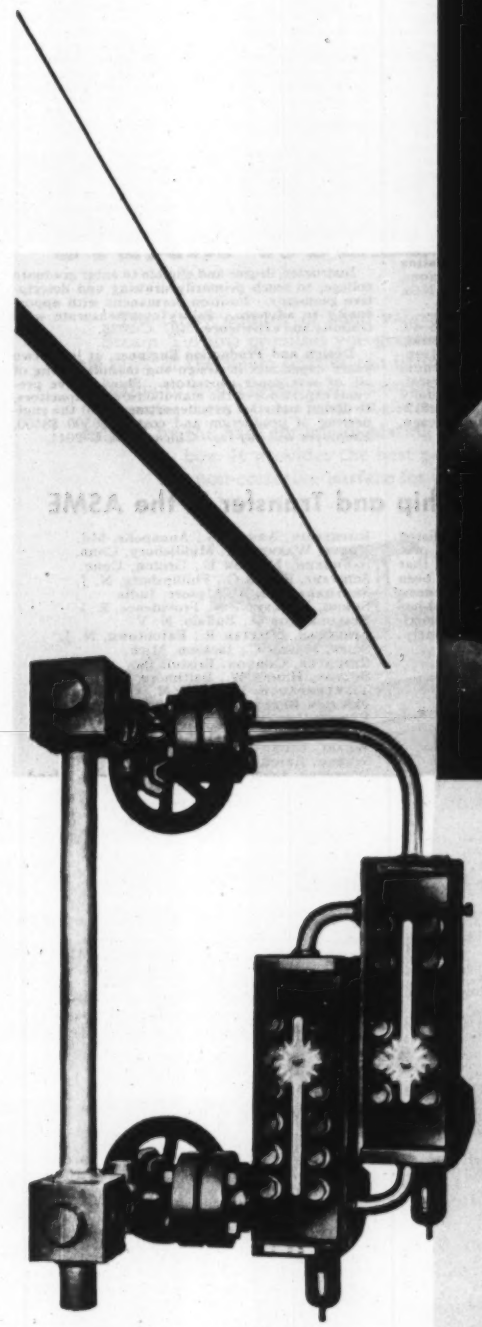
Chief Plant Engineer, 33–45; from five to ten years' experience in modification and construction of buildings and utilities, installation of equipment, etc., for aircraft manufacturing company. $8000–$10,000. Conn. W-124.

Dean of Faculty, 35–50; to take charge of academic program, 1600 students, 140 full-time faculty. Must have engineering, educational, and experience background with sound public-relations aptitude. Full-year responsibility with one-month vacation annually. Reasonable participation in consulting work permissible. $12,000. Midwest. W-144.

Chief Engineer, 35–45, graduate mechanical, experienced in design of pressure vessels, know the boiler codes, and be well qualified in the economical fabrication of such products. Manufactures low-pressure domestic boilers. $10,000–$12,000. 400 miles from New York, N. Y. W-154.

(*ASME News continued on page 710*)

[1] All men listed hold some form of ASME membership.



Yarway High Pressure Boiler Water Gage with separated-design flat glass inserts. Write for Yarway Bulletin WG-1812

HE'S A SPECIALIST ON STAINLESS STEEL INLAYS

● A dentist? No.

He's a Yarway craftsman. In the picture above he is milling a gasket groove in the stainless steel facing that is used for this important part of a high pressure boiler water gage body.

The man is important; so is the inlay.

The man is typical of the skilled workmanship that goes into every Yarway gage, blow-off valve, steam trap or other product —workmanship that makes no compromise with quality.

The stainless steel facing is typical of advanced Yarway engineering design. That inlay is but one of twelve basic improvements made in Yarway high pressure water gages.

When buying boiler water gages as well as other steam plant equipment, measure the cost in terms of good engineering, quality, workmanship, and dependable service.

"Make Yarway your way."

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
Branch Offices in Principal Cities

YARWAY

steam plant equipment

BLOW-OFF VALVES
WATER COLUMNS AND GAGES
REMOTE LIQUID LEVEL INDICATORS
EXPANSION JOINTS
DIGESTER VALVES
STEAM TRAPS
STRAINERS
SPRAY NOZZLES

Chief Engineer, 40–45, mechanical degree, to take charge of entire engineering program; will be directly responsible for research and development, for a manufacturer of machine tools. Will act in an advisory and consulting capacity to all branches of engineering. $20,000–$25,000, plus bonus. New England. W-159.

Industrial Engineer, graduate, about 30, who has had at least two years' experience in the industrial-engineering phase of cost work. Some experience in textile industry is also necessary. Some travel between plants in the South. $6500. Headquarters, South. W-184.

General Manager of Production Engineering, 35–45, preferably graduate mechanical engineer, for a large multiplant manufacturer of containers, container-manufacturing equipment, and other products. Must be familiar with design and operation of high-speed automatic machinery used in fabrication of metal products. Some experience including direct-line responsibility for manufacturing operations. Will direct development of procedures for efficient operation and maintenance of plants, facilities, and equipment, including central-production engineering staff; collaborate with other line and staff heads in development of new and improved materials, equipment techniques, facilities, etc. $18,000–$22,000, plus incentive plan; also insurance and pension benefits. New York metropolitan area. W-191.

Vice-President of Operations, for a multiplant manufacturer of a diversified line of heavy industrial products, 38–48, degree in engineering. Will co-ordinate and direct policies of management in seven autonomous divisions whose total sales volume approximates $10 million annually. Will work closely with head of each division and assist in sales, sales planning, production planning, and operating. Should have had some experience in a company producing heavy ferrous products. $40,000–$45,000, plus participation in an executive bonus plan; also pension, hospitalization, etc. Pa. W-192.

Executive Director, engineering graduate, executive, managerial, and administrative experience in educational, scientific, and industrial fields to promote and manage educational-activities conferences, exhibits, meetings, develop technical and industry-group activities for technical society. $12,000–$15,000. East. W-196.

Associate Professor. PhD degree in mechanical engineering, to teach graduate courses and also considerable research work. Salary open; some opportunity for summer teaching and research. Va. W-197.

Associate Editor, 30–35, mechanical-engineering graduate, at least five years' materials engineering experience covering metals and materials in electromechanical instrument and equipment fields. $6500–$7500. New York, N. Y. W-206.

Director of Engineering, BSME, 35–45, will take charge of a group of 60 to 75 people. The work will involve supervision of research, development, engineering, and product design for a mechanical industry utilizing all types of materials, as wood, textiles, plastics, and steel. Should have some knowledge of chemical operations. Salary open; company also offers executive bonus, annuities, and insurance. Midwest. W-207.

Sales Manager, to establish aggressive dealerships throughout country, to organize and direct a sales staff; with a record of volume sales in the machine-tool field. Long-term association with dealers and large industrial users of metalworking machinery. Must know every phase of promotion of fine imported machine tools and accessories. About $10,000. New York, N. Y. W-215.

Managers. (*a*) Manager, field sales and service, 35–40, degree in engineering and/or business administration. Will conduct the field sales and service activities for electronics-equipment division of larger operation. Experience in electronics, electrical, or allied fields serving industrial markets required. $12,000–$15,000, plus performance bonus. New England. (*b*) Manager, district sales office, 32–38, degree in engineering and/or business administration. Will conduct sales and service activities. Should have experience in electronics, electrical, or allied fields serving industrial markets. Must have actual selling plus at least a minimum of sales management or administration. $8000–$11,000 a year, plus performance bonus. Midwest. W-217.

Chief Industrial Engineer, 35–45, at least five years' experience in top supervisory position in industrial engineering; knowledge of woodworking helpful. Will supervise complete revision of incentive system and all other industrial-engineering functions covering costs, methods, time study, etc., for a manufacturer of wood products. Salary open. Wis. C-1971.

Foundry Manager, engineering degree, 35–45, with knowledge of gray-iron foundry practice and metallurgy. Will be responsible for foundry operations and sales; will report to president of company. Up to $12,000. Company will negotiate fee. Chicago, Ill. C-1981.

Development Engineer, BSME, 22–35, one to two years' experience in tool and die woodworking tools, product development, testing laboratory work, or metallurgical work. Must have knowledge of basic engineering principles to develop new products for flame-plating process, including laboratory work, field testing, customer contacts on technical problems, correspondence, and trouble shooting. $4500–$7000. Employer will negotiate fee. Some traveling. Ind. C-2000.

Design Engineer, mechanical, to handle design of central-station heating plants, air conditioning, and plumbing. Must be familiar with heating and plumbing principally on air-base installations, schools, and office buildings. To $7500. Neb. C-2003.

Chief Mechanical Engineer, graduate, 35–40, eight to ten years' experience in engineering, managerial, developmental; with knowledge of centrifugal pumps, heat transfer, filtration (vacuum and pressure). Will actively direct mechanical-engineering division both in discharge of daily duties and in developmental work. $8000–$12-000. Some traveling; a car is required. Chicago, Ill. C-2008.

Canadian Sales Engineer, mechanical, 30–40, must be a Canadian citizen, experienced to sell steam-power plants or operate power plants with sales aptitude. Will assist in forming a new Canadian company and sell well-known American line of power-plant instruments and controls for steam plants. Will sell, service, and eventually supervise assembly. Straight commission and stock participation. Must handle this line only. C-2017.

Welding Sales Engineer, to 32, at least one year's experience in industrial sales or application of welding products; knowledge of electrical equipment helpful. Will handle full line of welding equipment for well-known manufacturer getting into the field with a new line. $4800–$6000. Traveling 20 per cent of the time and a car is required. Chicago, Ill. C-2025.

Instructor, degree and eligible to enter graduate college, to teach primarily drawing and descriptive geometry. Position permanent with opportunity to advance. Salary commensurate with training and experience. Ill. C-2026.

Design and Production Engineer, at least two years' experience in design and manufacturing of oil, or wax-paper capacitors. Should have previous experience in the manufacture of capacitors, to design and start new department and the engineering of production and costs. $6500–$8500. Employer will pay fee. Chicago, Ill. C-2041.

Candidates for Membership and Transfer in the ASME

THE application of each of the candidates listed below is to be voted on after Aug. 25, 1954, provided no objection thereto is made before that date and provided satisfactory replies have been received from the required number of references. Any member who has either comments or objections should write to the Secretary of The American Society of Mechanical Engineers immediately.

Key to Abbreviation

R = Re-election; Rt = Reinstatement; Rt & T = Reinstatement and Transfer to Member

New Applications

For Member, Associate Member, or Affiliate

ADAMS, JACK B., El Dorado, Ark.
ALTHOUSE, JOSEPH G., Coatesville, Pa.
BAILEY, ROBERT D., Wheatridge, Colo.
BARTZ-JOHANNESSEN, SIGFINN, Bergen, Norway
BEAUMONT, FRANCIS E., Philadelphia, Pa.
BEVAN, HENRY G. M., Barranquilla, Colombia, S. A.
BOALS, ROY L., Portland, Ore.
BOUDREAU, WILLIAM F., Oak Ridge, Tenn.
BRAULT, EUGENE E., Orange, N. J.
CHASKO, WILLIAM E., N. Hollywood, Calif.
CHILSON, FRANCIS, East Chatham, N. Y.
COCHRAN, ELVIN P., JR., Fresh Meadows, N. Y.
COLE, CLARE L., Corning, N. Y.
COOK, HARVEY M., JR., Tullahoma, Tenn.
DODSON, ROBERT W., Shreveport, La.
DULIN, RALPH V., Richland, Wash.
ELLIS, JOHN T., JR., Des Plaines, Ill.
ERMINELLI, FREDERICK L., Pawtucket, R. I.
FERLAZZO, ANTHONY J., Bloomfield, N. J.
GESSNER, GENE A., Lincoln, Neb.
GOLDSMITH, ALEXANDER, Chicago, Ill.
HANSON, ARTHUR C., Davenport, Iowa
HARTMAN, ALBERT M., Whiting, Ind.
HIGGINS, WALTER C., West Hempstead, N. Y.
HUBER, MATTHEW W., Watertown, N. Y.
HURC, CASS F., Janesville, Wis.
HUTCHINS, KENNETH A., Royal Oak, Mich.
JOHNSON, THOMAS H., Peninsula, Ohio
JUDSON, WILLIAM H., Wayne, Pa.
KESSELRING, KENNETH A., Schenectady, N. Y.
KESSLER, LEWIS H., Kansas City, Mo.
KITNOVSKI, BERNARD B., Sorel, Que., Can.
KLOPFER, EDWARD L., Kenmore, N. Y.
KOLBACH, CHARLES G., Fanwood, N. J.
KURLAND, PAUL, Middletown, N. Y.
LOWE, DONALD F., Charleston, W. Va.
LOWE, WILLIAM E., Honolulu, T. H.
MALESON, LEONARD, Elkins Park, Pa.
MCBRIDGE, PAUL F., Natick, Mass.
MONCRIEF, RUFUS S., Shreveport, La.
MONSERRAT, JOSE H., Cordoba, Argentina, S. A.
MORSE, WILLIAM H., JR., Edgerton, Wis.
NINNEMAN, LAWRENCE C., Toledo, Ohio
PELITTI, ENRICO, Stamford, Conn.
RICHARDSON, WILLIAM B., Silver Spring, Md.
ROBBINS, FREDERICK A., Baltimore, Md.
RODRIGUEZ, RODRIGO B., Mexico City, D. F., Mex.
ROGERS, KENNETH L., Methuen, Mass.
ROHWEDER, WILLIAM T., Toledo, Ohio
ROONEY, SIDNEY C., Vancouver, B. C., Can.
ROTHSTEIN, ARNOLD J., Annapolis, Md.
ROUSE, WARREN E., Middlebury, Conn.
SANDGREN, NELSON E., Groton, Conn.
SCHWARZ, ROGER G., Phillipsburg, N. J.
SEETHARAMIAH, A., Mysore, India
SHENG, AUGUSTINE S., Providence, R. I.
STALDER, JOE O., Buffalo, N. Y.
STRINKAN, WILLIAM R., Eatontown, N. J.
STIFF, MASON C., Jackson, Mich.
STRUBLER, GORDON, Bristol, Pa.
SUTTON, HARRY W., Baltimore, Md.
TINKLERPAUGH, KENNETH N., Oxnard, Calif.
VAN DEN BERG, HENDRIK, Trinidad, B. W. I.
VERMA, VISHAN B., Chheharta, India
WALD, DAVID, Brooklyn, N. Y.
WEAST, LLOYD E., JR., Kansas City, Mo.
WEBER, ERICH C., Concord, Calif.
WHEELER, LEONARD R., Stirlingshire, Scotland
WHITE, WALTER, C., Brooklyn, N. Y.
WILDRIDGE, GEORGE A., Palmyra, N. Y.
WOOD, DERRK, Ottawa, Ont., Can.
ZICK, LEONARD P., JR., Chicago, Ill.

Change in Grading

Transfers to Member, Associate Member, or Affiliate

BELZ, LLOYD H., Newman Lake, Wash.
HAMILTON, JOHN S., JR., Birmingham, Ala.
KRACHIE, EDWARD C., Berkeley, Calif.
NEWHOUSE, KEITH N., Lincoln, Neb.
PIASECKI, RICHARD F., Tullahoma, Tenn.

Transfers from Student Member to Associate Member 412

Obituaries . . .

Charles Edgar Beck (1884–1954), mechanical engineer, heavy machinery division, Nordberg Manufacturing Co., Milwaukee, Wis., died May 1, 1954. Born, Joliet, Ill., Dec. 1, 1884. Parents, Frank J. and Mary (Egley) Beck. Education, BS(ME), Illinois Institute of Technology, 1911. Married Elizabeth Erwood, 1912; son, Charles E. Jun. ASME, 1911; Assoc Mem. ASME, 1918; Mem. ASME, 1935. Served the Society as member, Executive Committee, Kansas City Section, 1938-1939; Executive Committee, Oil and Gas Power Division.

George William Bollinger (1908–1954?), whose death was recently reported to the Society, was power engineer, West Virginia Paper & Pulp Co., Charleston, S. C. Born, Altoona, Pa., Jan. 5, 1908. Education, graduate, Williamson Technical School, 1928. Author of technical papers on condenser performance. Mem. ASME, 1947.

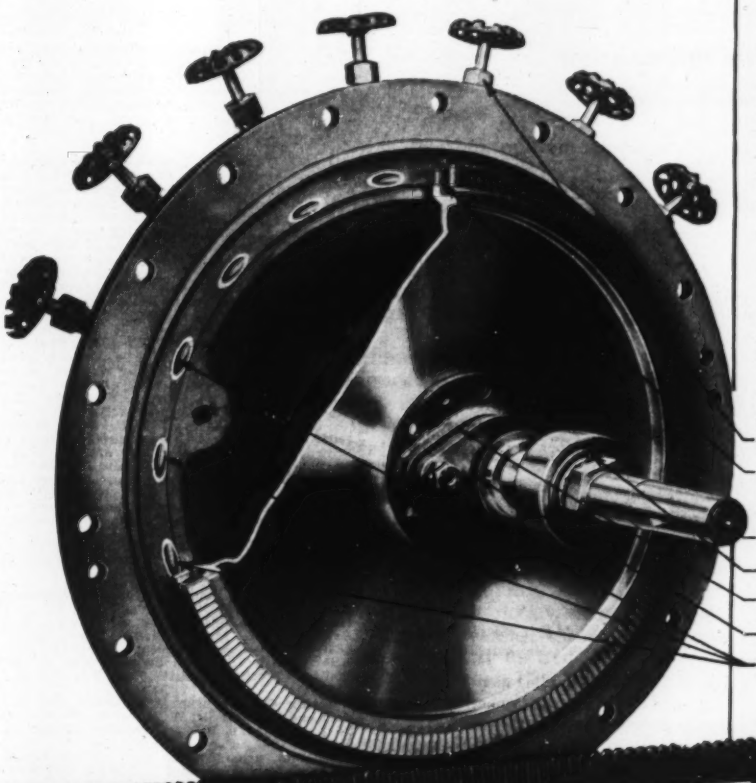
Charles Frederick Dallas (1882–1953), general manager, The Antillian Construction Co., Havana, Cuba, died April 10, 1953. Born, Omaha, Neb., April 9, 1882. Education, BS(ME), University of Tennessee, 1902. Mem. ASME, 1919.

(*ASME News continued on page 712*)

No other steam turbine offers you

SUCH VERSATILE STEAM NOZZLE CONTROL

The larger number of hand valves you see on a Coppus Steam Turbine promises you greater operating economy. At least 60% of the steam nozzles can be individually controlled to give maximum steam pressure in steam chest . . . a guarantee of best water rates at any load. Maintenance economy, too, is assured by the hard chromium plating of the shaft at the stuffing box. It provides the best possible smooth, non-corrosive surface for packing rings.



- 7 hand valves for efficient partial load operation, (20" turbine shown)
- 2 row velocity-stage turbine wheel with stainless steel turbine buckets — statically and dynamically balanced
- 30-40 carbon steel shaft
- Oversized double row deep grooved ball bearing
- Stuffing box with metallic packing ring
- Heavy chrome plating of shaft through stuffing box
- 3 nozzles always open

Coppus Steam Turbines, Type TF, driving chemical transfer pumps at Celanese Corporation of America's Chemcel Plant

Coppus Steam Turbines ranging from 150 hp down to fractional in 6 frame sizes

MAKE TURBINE DOLLARS GO FARTHER

Why waste money buying turbines with higher horsepower ratings than you need? The higher the horsepower rating, the higher the price. Save money by selecting the Coppus Turbine size closest to your requirements from 150 hp down to fractional. And when you do, you save operating and maintenance costs, too. That's what these other Coppus features are designed to do: exclusive pilot operated excess speed safety trip supplementing constant speed governor; choice of metallic or carbon ring packing assemblies. Designs available for back pressures up to 75 pounds; replaceable cartridge type bearing housings. For full details . . .

WRITE FOR BULLETIN 135

COPPUS ENGINEERINC CORP., 368 Park Avenue, Worcester 2, Mass. Sales offices in THOMAS' REGISTER.

COPPUS "BLUE RIBBON" TURBINES

George Austin Fishel (1901–1953), whose death on Aug. 13, 1953, was recently reported to the Society, was squad leader, Elliott Co., Jeannette, Pa. Born, Pittsburgh, Pa., May 13, 1901. Education, BS(ME), Bucknell University, 1924. Mem. ASME, 1948.

Keep Your ASME Records Up to Date

ASME Secretary's office in New York depends on a master membership file to maintain contact with individual members. This file is referred to dozens of times every day as a source of information important to the Society and to the members involved. All other Society records and files are kept up to date by incorporating in them changes made in the master file.

From the master file are made the lists of members registered in the Professional Divisions. Many Divisions issue newsletters, notices of meetings, and other materials of specific interest to persons registered in these Divisions. If you wish to receive such information, you should be registered in the Divisions (no more than three) in which you are interested. Your membership card bears key letters opposite your address which indicate the Divisions in which you are registered. Consult the form on this page for the meaning of the letters. If you wish to change the Divisions in which you are registered, please notify the Secretary's office.

It is important to you and to the Society to be sure that your latest mailing address, business connection, and Professional Divisions' enrollment are correct. Please check whether you wish mail sent to home or office address.

For your convenience a form for reporting this information is printed on this page. Please use it to keep the master file up to date.

ASME Master-File Information

(Not for use of student members)

Please print **Check mailing address**

Name ..... (Last, First, Middle)

Home address ..... ☐ (Street, City, Zone, State)

Name of employer .....

Address of employer ..... ☐ (Street, City, Zone, State)

Product or service of company .....

Title of position held .....

Nature of work done .....

I am a subscriber to (please check)

Publication	*Address changes effective when received prior to:*
☐ Mechanical Engineering	10th of preceding month
☐ Transactions of the ASME	20th of preceding month
☐ *Journal of Applied Mechanics*	20th of preceding month
☐ *Applied Mechanics Reviews*	1st of preceding month

Please register me in three Professional Divisions as checked:

☐ A—Aviation	☐ J—Metals Engineering	☐ S—Power
☐ B—Applied Mechanics	☐ K—Heat Transfer	☐ T—Textile
☐ C—Management	☐ L—Process Industries	☐ V—Gas Turbine Power
☐ D—Materials Handling	☐ M—Production Engineering	☐ W—Wood Industries
☐ E—Oil and Gas Power	☐ N—Machine Design	☐ Y—Rubber and Plastics
☐ F—Fuels	☐ P—Petroleum	☐ Z—Instruments and Regulators
☐ G—Safety	☐ R—Railroad	
☐ H—Hydraulics		

Gustaf Adolph Gaffert (1901–1954), consulting engineer and partner in the firm of Sargent & Lundy, Chicago, Ill., died May 6, 1954. Born, Worcester, Mass., Sept. 1, 1901. Parents, August and Olga Eugenia Gaffert. Education, BS(ME), Worcester Polytechnic Institute, 1923; ME, 1925; DS, University of Michigan, 1934. Jun. ASME, 1923; Assoc-Mem. ASME, 1930; Mem. ASME, 1935; Fellow ASME, 1951. He served the Society on the Executive Committee of the Power Division and was chairman twice; and as secretary, ASME Special Standards Committee on Steam Turbines. Author of "Steam Power Stations"; coauthor of Section 10, "Standard Handbook for Electrical Engineers"; and wrote several articles for technical and scientific journals. Survived by wife and two daughters, Ellen Joyce and Judith May.

Albert A. Hoffman (1880–1954), consulting engineer, vice-president, and member of board of directors, Calaveras Cement Co., San Francisco, Calif., died May 4, 1954. Born, Parsons, Kan., July 28, 1880. Parents, John P. and Lavina Hoffman. Education, BS, University of Kansas, 1905. Married Edith Morgan, 1916. Mem. ASME, 1918. Survived by wife, a son, two daughters, a brother, three sisters, and six grandchildren.

Robert Elkan Naumburg (1892–1952), mechanical engineer in charge of research, Jonas and Naumburg, New York, N. Y., died in October, 1952, according to a notice recently received by the Society. Born, New York, N. Y., March 22, 1892. Parents, Max and Theresa (Kahnweiler) Naumburg. Education, BA, Williams College, 1913; BS, Massachusetts Institute of Technology, 1916; postgraduate study, patent law, Harvard University law school. Married Rosalind Paradise, 1921. Married 2nd, Sophia Singer, 1937. Held several patents on cotton and various textile machines and mechanical and electrical devices. Author of many papers presented to professional societies. Recipient of Wetherill Medal of The Franklin Institute, 1935; he invented the automatic visagraph. Jun. ASME, 1917; Mem. ASME, 1924.

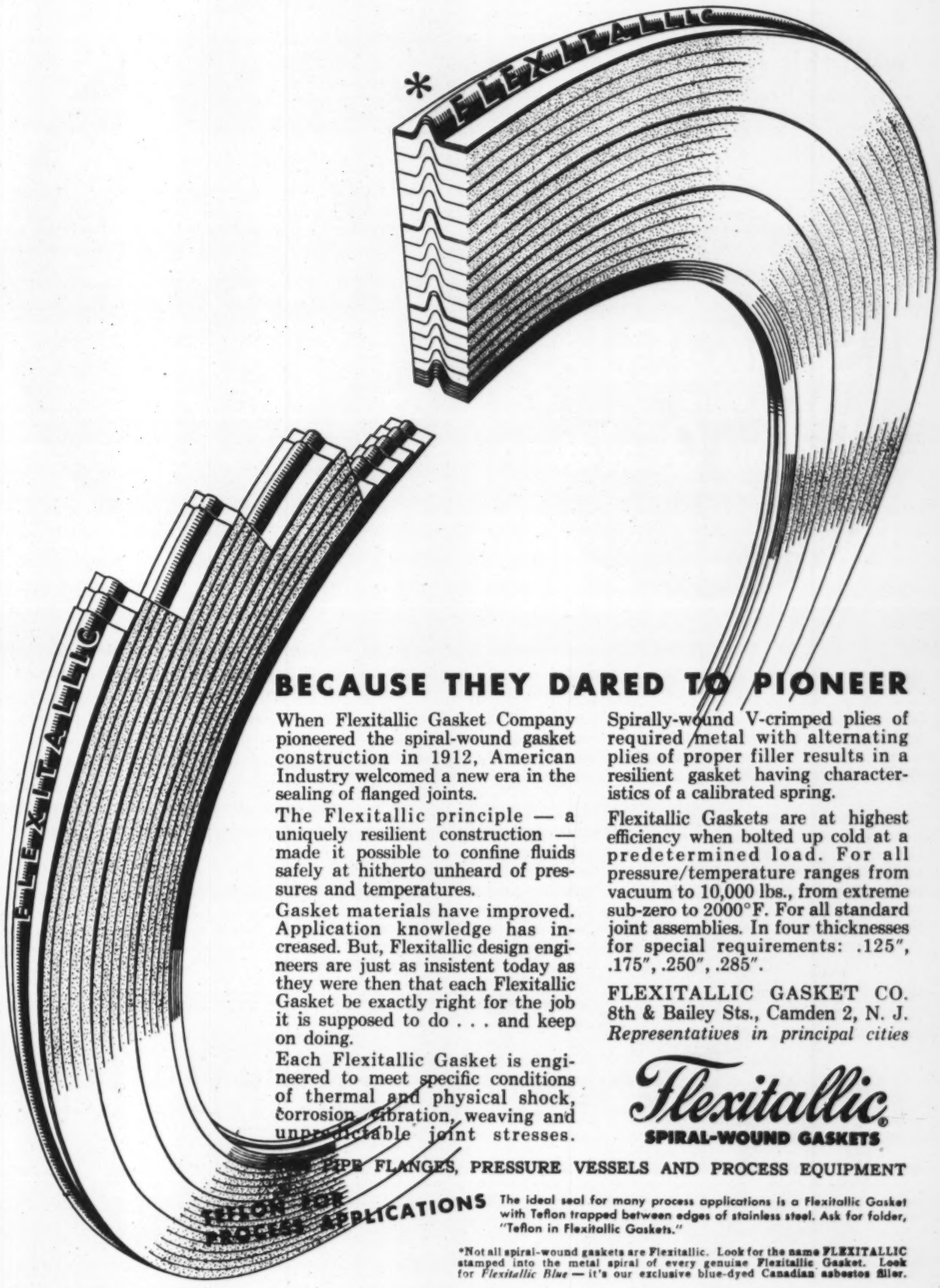
Gustav W. Schwab (1885–1954), retired sales engineer, American Gas Furnace Co., Elizabeth, N. J., died Jan. 26, 1954. Born, Heven, Westphalia, Germany, Feb. 1, 1885. Parents, Carl A. and Lisette (Kuhlhoff) Schwab. Education, Real gymnasium, Witten, Ruhr, Germany; Royal Hill Engineering School, Hagen, 1908; postgraduate, Chemical Technical Institution, University of Karlsruhe, Baden, 1912-1913. Married 2nd, Josephine Hosek, 1925; children (first marriage) Margaret and Gustav; (second marriage) Robert. Mem. ASME, 1943.

Henry Dexter Sharpe (1872–1954), chairman of the board, Brown & Sharpe Manufacturing Co., Providence, R. I., died May 17, 1954. Born, Providence, R. I., Dec. 12, 1872. Parents, Lucian and Louisa (Dexter) Sharpe. Education, BA, Brown University, 1894; hon. MA, 1920. Married Mary Elizabeth Evans, 1920. Assoc. ASME, 1901. For 52 years he was directing head of Brown & Sharpe, one of the nation's largest machine-tool and precision small-tool manufacturers. He had many other business interests and took an extremely active part in civic affairs. He was a founder of the New England Council; in 1932 he became chancellor of Brown University. Survived by wife; son, Henry D., Jr.; three sisters, Ellen D., Providence, R. I.; Mrs. William Y. Peters, Boston, Mass.; and Mrs. Jesse H. Metcalf, Providence, R. I.

Hiram Gordon Smith (1893–1954), consultant, E. I. du Pont de Nemours and Co., Inc., Old Hickory, Tenn., died April 23, 1954. Born, Baltimore, Md., March 9, 1893. Education, BS-(EE), Georgia School of Technology, 1916. Mem. ASME, 1930. Survived by wife, Mrs. Drusilla Smith; a brother and sister.

Walter G. W. Turno (1887–1954), vice-president and engineer, H. W. Porter & Co., Newark, N. J., died Jan. 6, 1954. Born, New York, N. Y., Feb. 22, 1887. Parents, Henry and Anna Turno. Education, attended The City College of The City of New York and Columbia University. Married Emily Halliday; two daughters, Dorothy and Ruth. Jun. ASME, 1913; Assoc-Mem. ASME, 1916; Member, ASME, 1921.

George Edwin Wearn (1881–1953), president, Wearn, Vreeland, Carlson & Sweatt, Inc., New York, N. Y., died Feb. 3, 1954. Born, Hickman, Ky., Dec. 3, 1881. Education, public schools and private tutors. Assoc-Mem. ASME, 1921; Mem. ASME, 1951. His wife died some time ago; survived by seven children, George E., Jr., Greenwich, Conn.; James P., Mem. ASME, Rutledge, Pa.; Robert D., Wayne, Pa.; Mrs. William Hartman, Worcester, Mass.; Mrs. George Detwiler, Wayne, Pa.; Mrs. Victor Troxell, Swarthmore, Pa.; Jane, Wayne, Pa.; and several grandchildren.



BECAUSE THEY DARED TO PIONEER

When Flexitallic Gasket Company pioneered the spiral-wound gasket construction in 1912, American Industry welcomed a new era in the sealing of flanged joints.

The Flexitallic principle — a uniquely resilient construction — made it possible to confine fluids safely at hitherto unheard of pressures and temperatures.

Gasket materials have improved. Application knowledge has increased. But, Flexitallic design engineers are just as insistent today as they were then that each Flexitallic Gasket be exactly right for the job it is supposed to do . . . and keep on doing.

Each Flexitallic Gasket is engineered to meet specific conditions of thermal and physical shock, corrosion, vibration, weaving and unpredictable joint stresses.

Spirally-wound V-crimped plies of required metal with alternating plies of proper filler results in a resilient gasket having characteristics of a calibrated spring.

Flexitallic Gaskets are at highest efficiency when bolted up cold at a predetermined load. For all pressure/temperature ranges from vacuum to 10,000 lbs., from extreme sub-zero to 2000°F. For all standard joint assemblies. In four thicknesses for special requirements: .125", .175", .250", .285".

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8th & Bailey Sts., Camden 2, N. J.
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Flexitallic®
SPIRAL-WOUND GASKETS

FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

TEFLON FOR PROCESS APPLICATIONS The ideal seal for many process applications is a Flexitallic Gasket with Teflon trapped between edges of stainless steel. Ask for folder, "Teflon in Flexitallic Gaskets."

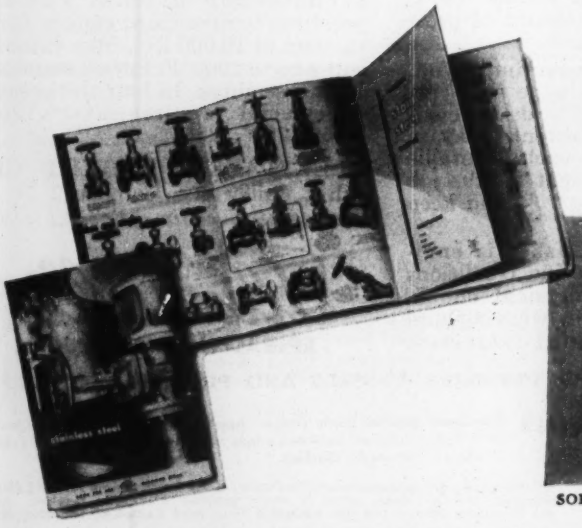
*Not all spiral-wound gaskets are Flexitallic. Look for the name FLEXITALLIC stamped into the metal spiral of every genuine Flexitallic Gasket. Look for *Flexitallic Blue* — it's our exclusive blue-dyed Canadian asbestos filler.

Trim costs with this hook-up for valve-killing corrosive services

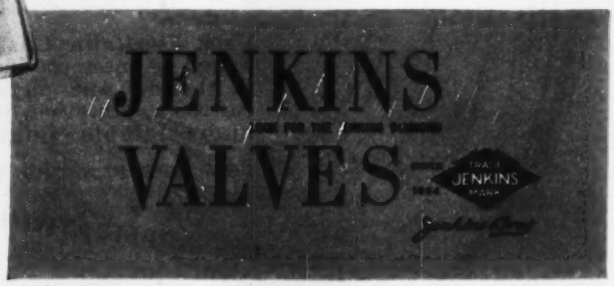
To end high valve mortality from most corrosive liquids, and to control fluids that must be kept free from contamination or discoloration, stainless steel is the right metal. But it takes more than metal to make a valve. For dependable performance, you need the two-way hookup — Stainless Steel *and* Jenkins time-proved Valve Engineering.

With the increased demand for processing equipment that resists corrosion, more and more Stainless Steel Valves have been added to the Jenkins line. It now includes types, designs, sizes and alloys to meet practically all industrial needs.

Let the famous Diamond trade-mark be your guide when you choose valves of stainless steel. As on *any* Jenkins Valve, it means *extra value* . . . longer, trouble-free service life.



NEW BOOKLET describes the wide range of types, sizes, pressures, and alloys available in Jenkins Stainless Steel Valves, with diagrams and dimensions. Includes description of alloys, helpful information on selection, and survey forms. Ask for Form 200. Jenkins Bros., 100 Park Ave., New York 17.



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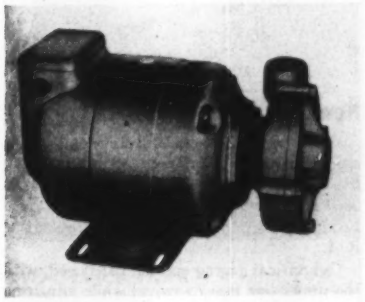
Available literature or information may be secured by writing direct to the manufacturer. Please mention MECHANICAL ENGINEERING

NEW EQUIPMENT

Four-Way Valves

A flexible arrangement which provides permanent plumbing for 1/2 in. Barksdale manifold four-way valves has been announced by Barksdale Valves, 5125 Alcoa Ave., Los Angeles 58, Calif. The company says valve replacement can be made in a matter of minutes by simply removing four bolts, and the piping remains undisturbed. All four lines may be brought up from the bottom, from four sides or in combination.

The valves are of the Shear-Seal design featuring leak-proof closure in vacuum to 2000 psi air service and 3000 psi water and oil service.

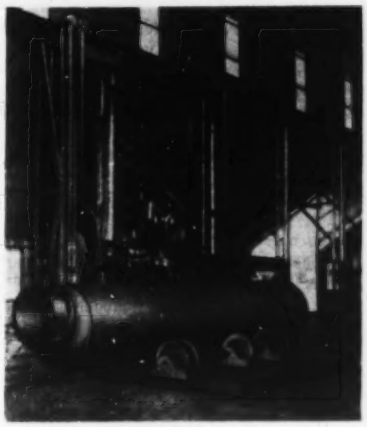


Centrifugal Pump

A new direct connected compact motor driven Rumaco centrifugal pump, Model D-501, has been developed by the Ruthman Machinery Co., Cincinnati, Ohio. The pump is said to be adaptable to various air conditioning installations, including evaporative condensers, medium size cooling towers, fountains and swimming pools, requiring up to 40 gpm at 30 ft head.

The unit is bronze fitted and will handle water and other liquids without danger of rust or corrosion even where used intermittently and during seasonable idle periods, the company claims. It is equipped with the latest improved type self adjusting seal, and is furnished with either 1/4, 1/2 or 3/4 hp motor. No additional mounting bracket is required.

The pump has been designed with ribbed sections to minimize weight and retain strength and rigidity.



Welding Machine

Master Tank and Welding, Dallas, Tex., announces a welding machine capable of handling pressure vessels up to 120 ft long by 16 ft in diameter and weighing 100,000 lb. The machine is all motor-powered and works by remote control from a front panel. The tank is rotated for welds around the circumference. The machine, with two welding heads travels under its own power on a track that is 120 ft long.

Conveyor-System Unit Booster

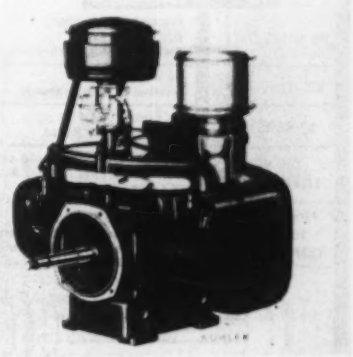
Lamson Corp., Syracuse, N. Y., has announced the marketing of a new Unit Booster. A complete package in itself, the Unit Booster can be incorporated into an engineered conveyor system or can be purchased and installed for special-purpose jobs, Lamson says. For normal package conveyor loads, it can be used for inclines up to 30 deg, according to the manufacturer.

Unit Boosters are made of a 5-ft drive and a 5-ft take-up section, which may be joined together to make a 10-ft unit. Five- or 10-ft lengths of intermediate section may be added to extend the booster in multiple lengths of 5 ft up to 60 ft. Unit Boosters are available in two widths, 18 in. and 30 in., and can be equipped with standard three-ply belting. The belting moves over rollers which extend above the side frame. If required, guard rails can be attached to the frame to guide the load. Standard gear-head motors from 1/3 to 1 hp are used to drive the 8-in. pulley and are mounted under or on the side of the drive section. Accessory equipment for the Unit Booster includes a tail belt powered by the unit booster, and floor or ceiling supports.

Process Eliminates Cementing Seals

A new process providing positive sealing between a housing bore and the outer case of metal-encased oil seal without cementing has been announced by National Motor Bearing Co., Inc. The new process, named National Redicoat, consists of a coating material applied at the National factories on the metal circumference of the oil seal. The coating serves as the sealer; no cement is required.

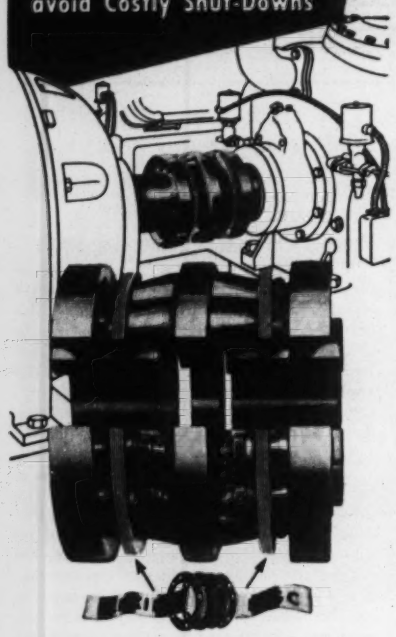
The coating material, tested under all conditions over a three-year period, is hard to the touch, does not adhere to containers, other seals or pick up dirt, and is brightly colored for ready identification. As the oil seal is introduced into a press-fit bore, the coating completely fills radial or circumferential scratches or imperfections as deep as .003 in. Once in place, the sealing is permanent and is unaffected by temperatures ranging from −60 to 350 F. No special preparations are needed for installation; and seals may be removed eaily even after prolonged operation at high temperature. Technical details are available from National Motor Bearing Co., Inc., Redwood City, Calif.



2-Cylinder Engine

Kohler Co.'s K660 heavy duty, two-cylinder opposed engine is now being offered in a direct mounting model designated as the K660P. It may be ordered with three different mounting pads and a variety of power take-off shafts. Dimensions for Model K660P include: length, 22 1/2 in.; width, 23 1/8 in.; height, 27 9/16 in. and weight, 225 lb. The power take-off shafts are available in lengths up to 6 9/16 in. The engine may be ordered with either a hand crank or an electric start. Power output for the new air-cooled, gasoline model ranges from 26.8 hp at 3600 rpm to 15 hp at 1800 rpm.

Specify THOMAS ALL METAL
FLEXIBLE COUPLINGS
for Power Transmission to avoid Costly Shut-Downs



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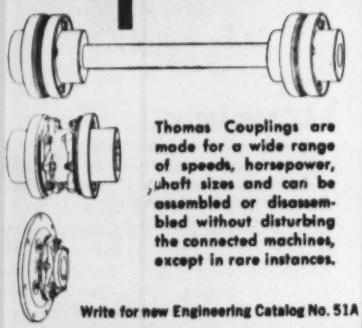
NO MAINTENANCE	Requires No Attention. Visual Inspection While Operating.
NO LUBRICATION	No Wearing Parts. Freedom from Shut-downs.
NO BACKLASH	No Loose Parts. All Parts Solidly Bolted.
CAN NOT "CREATE" THRUST	Free End Float under Load and Misalignment. No Rubbing Action to cause Axial Movement.
PERMANENT TORSIONAL CHARACTERISTICS	Drives Like a Solid Coupling. Elastic Constant Does Not Change. Original Balance is Maintained.



Thomas Couplings are made for a wide range of speeds, horsepower, shaft sizes and can be assembled or disassembled without disturbing the connected machines, except in rare instances.

Write for new Engineering Catalog No. 51A

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA, U.S.A.

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Bellows Type Packless Valve

A bellows type packless valve designed in hand operated or pneumatic-hydraulic models is announced by the Clifford Mfg. Co., 152 Grove St., Waltham 54, Mass.

The all-metallic construction of these valves which eliminates the use of sliding or restrictive packings insures a positive leak tight seal and minimizes wear and deterioration. Long service life and minimum maintenance is claimed.

The hand operated valve features a ball joint construction in the handle which prevents torque from being transmitted to the bellows and valve stem so that the valve is seated by a straight vertical thrust with no rotating motion. Leak tight, all metallic construction with bellows operation makes the valves especially suitable for high vacuum systems such as laboratory equipment, exhaust systems for hermetically sealed products such as electronic equipment or aircraft components, mass spectrometers and similar service.

The pneumatic-hydraulic model is especially well suited for multiple manifold set ups and remotely operated valves. Standard models are conservatively rated for pressures up to 150 psi and with minor modifications, can be adapted for much higher pressures. The valves are also recommended for extreme-temperature service from −65 F to 250 F in the standard models, with much greater extremes possible with small modifications on special order.

Other applications include the handling of volatile liquids and gases and corrosive fluids. In this type of service the metallic sealing of the valve stem reduces hazards of fire and explosion and corrosive attack. Bellows of corrosion resistant metals such as stainless steel and monel can be furnished.

The pneumatic-hydraulic operated model operates on line pressures of 10 to 150 psi. The valve seat is spring loaded to insure positive opening action when actuating pressure is released. Inlet and outlet fittings are $\frac{1}{8}$ in. female pipe tap on both valves as is also the actuating pressure line connection on the pneumatic-hydraulic valve.

Coolant Feed Manifold

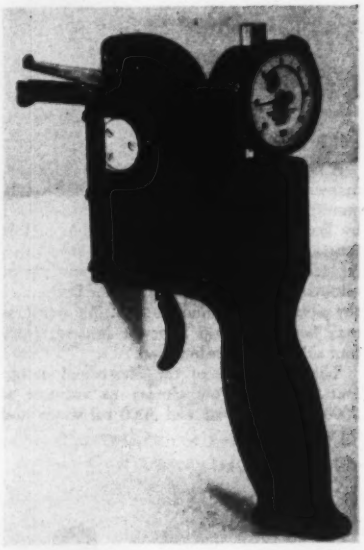
A new coolant feed manifold has been announced by the Graymills Corp., 3705 N. Lincoln Ave., Chicago 13, Ill., as an "engineered" system for applying coolant to multiple drilling operations.

It eliminates mess, provides better coolant application for longer tool life and saves time by ending constant, troublesome nozzle adjustments. It can be easily and quickly mounted on most standard 4 or 8 drill heads. A split ring design makes it unnecessary to remove the drill head for installation. Coolant is directed to the point of the drill. Eight removable, adjustable nozzles are supplied with the manifold, but it is designed to accommodate up to 16 nozzles.

New catalog sheet showing prices, dimensions and installation data is available from the company.

New Wing Nuts

Wing type Palnut lock nuts are now available in a new size, $\frac{9}{16}$ in.–18 in. addition to the former stock sizes of 6–32, 8–32, 10–32, 10–24 and $\frac{1}{4}$ in.–20. These tempered spring steel lock nuts combine the standard Palnut locking design with the convenience of ample wings for finger tightening. Full data and free samples available from the Palnut Co., 61 Cordier St., Irvington 11, N. J.



New Gear Gage

What is said to be a new approach to inspecting pitch diameters of spur gears, helical gears, splines, and chain sprockets is used in a gear gage developed by Federal Products Corp., 1144 Eddy St., Providence, R. I.

Cylindrical gaging contacts are used, with the upper one free to swivel while adjusting it to the master. When it is seated properly in relation to the lower contact, it is locked in position. The company says this arrangement provides more stability than it is possible to get with floating contacts. An adjustable rear guide helps to locate the gage in the proper spaces between the gear teeth. Pitch diameters of gears having either an even or uneven number of teeth can be inspected.

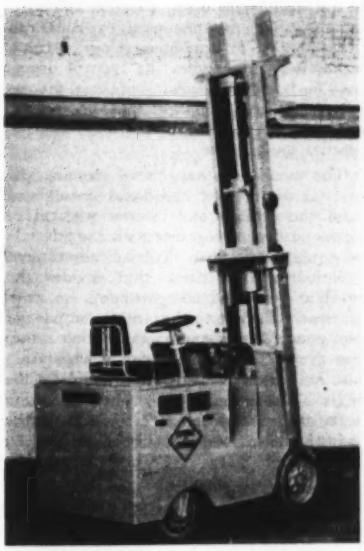
A thumb lever lifts the upper contact so that it will clear the maximum diameter of the gear. The contact is then allowed to settle between the teeth and find its own position. The operator cannot influence this operation with the thumb lever. The upper contact is spring loaded to offset the weight of the gage and any reasonable pressure from the operator.

There are five sizes in the regular series—model numbers 202P-201 through 202P-205—each of which has one full in. of adjustment. The gages are portable.

Dealkalizing Salt Splitter

For small and medium sized plants, the new Cochrane dealkalizer, announced by the Cochrane Corp., 17th St. and Allegheny Ave., Philadelphia 32, Pa., utilizes a strongly basic anion exchange resin capable of salt splitting and substituting chloride anions, for bicarbonate, carbonate, sulphate and nitrate radicals.

It is claimed that this process of chloride anion exchange greatly reduces alkalinity without use of acids and reduces CO_2 in steam, and provides continuous treatment under pressure, among other advantages. Together with the Cochrane Zeo-Flo softener which precedes the dealkalizer, the unit is designed to provide custom-engineered systems at practically stock costs.



Electric Fork Truck

A 5000 lb capacity, electric powered fork truck has been introduced by the Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland 3, Ohio. The truck, Model F-30T5, features contactor controls, worm drive, caster trail axle, packaged unit assemblies, and a rocker arm tilt.

Additional features include front wheel drive, rear wheel steer, a tilting, telescoping mast, and center control. It has: travel speeds with full load of 5½ mph; without load, 6 mph; lifting speeds with full load, 25 fpm; without load, 42 fpm; lowering speeds with full load, 45 fpm; without load, 36 fpm.

The hoist and tilt mechanism is hydraulically operated; a gear type pump connected to the electric motor supplies the pressure. A double-acting tilt cylinder operates through a lever and shaft, applying equal force to both sides of the uprights and assuring rigid support and reduced side sway. Low hydraulic pressures are used.

Gas-Fired Furnace

A new horizontal gas-fired furnace for meeting a wide range of applications and space conditions has just been announced by Iron Fireman Mfg. Co., Cleveland 11, Ohio.

Shipped as a packaged unit, the furnace is delivered completely assembled with all controls except the thermostat mounted. Flue outlets on both sides of the cabinet make it possible to attach flue and draft diverter connections to either side. The burner and control assembly may also be mounted on either side of the heavy-gage cabinet.

The blower, driven by a permanently lubricated ball bearing motor, is of the double inlet, multi-blade centrifugal type. The burner is especially engineered for use with these furnaces to obtain exceptional combustion efficiency with any type of gas. The heat exchanger, of welded heavy steel, is designed to prevent expansion and contraction noises. The furnace comes in four sizes, ranging from 64,000 to 112,000 Btu at the bonnet.

Wheel Conveyors

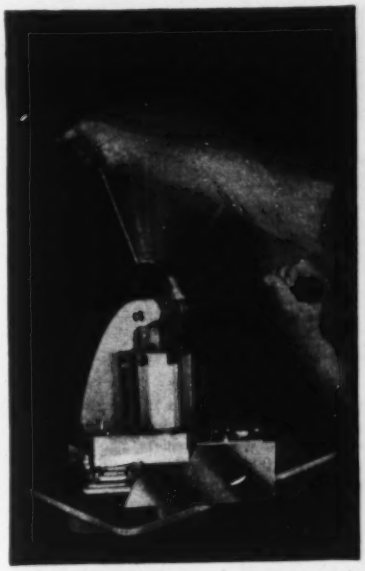
Sturdy, single and double line wheel conveyors that can be installed permanently or moved to the job and used either singly or in pairs on storage racks, shipping and receiving platforms or assembly lines, are being offered by Harry J. Ferguson Co., Jenkintown, Pa. The conveyors, which are available in 10-ft lengths, have 2-in. diam × ⅝ in. steel ball bearing wheels bolted either inside or outside of angles. Wheels can be on 1½, 2, 3, 4 or 6-in. centers and each unit is constructed to permit utmost freedom of package travel.

Air Supply Filter

A compact air filter, designed to prevent dirt, oil, water and other foreign matter from entering pneumatic instruments, has been announced by The Foxboro Co., Foxboro, Mass. The new filter consists of four major elements: a top cap with supply and outlet connections; a chamber with a drain cock at the bottom; a resin impregnated filtering sleeve; and a water baffle. The unit measures approximately 8½ in. × 4½ in. and can be mounted in a supported line or bolted to a wall or panel.

Supply air enters through the inlet port, strikes a baffle plate on the cap, enters the chamber, passes through the filter and leaves through the outlet port. Moisture drops to the bottom of the chamber and is easily drained off or blown out through the drain cock. The filter sleeve, of moisture-resistant cellulose, removes particles as small as 40 microns. It is inexpensive and can be easily cleaned or replaced.

Filter capacity is 4 cfm of air or natural gas; sump capacity is 12 cu in.; filtering area, 21.2 sq in.; and maximum working pressure, 150 psi. Supply and outlet connections are ¼ in. NPSF. Complete specifications and description are contained in technical report, TI 29-A-92a, copies of which will be sent on request to the company.



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Speed up notching operations, eliminate the need for heavy presses and dies with a Di-Acro Notcher. A 6"x6" notch can be made in 16 gauge material in one operation. Many straight shearing jobs also performed.

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Di-Acro Power Notcher is especially designed for operations where high rate of production must be maintained. Motor driven flywheel and all moving parts housed in welded, steel cabinet.

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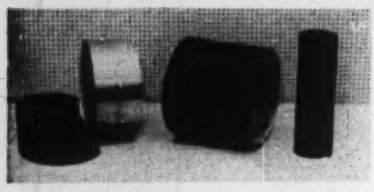


Non-Slip Surfacing

A new type of Safety-Walk waterproof non-slip surfacing with a mineral coating of traprock has been developed especially for pulley lagging by Minnesota Mining and Mfg. Co., 900 Fauquier St., St. Paul 6, Minn.

Known as types "E" and "F," the surfacing is a thin, tough fabric flexible enough to be adapted for use on any type of industrial pulley. It can be spiral-wound or applied in sections. Both types are identical but the method of application differs. Type "E" requires a separate adhesive and type "F" is manufactured with a pressure sensitive adhesive backing.

The company claims the non-slip surfacing is fire-retardant, economical, and is resistant to oil, grease and water. It is available nationally in rolls up to 24 in. wide through industrial supply distributors.

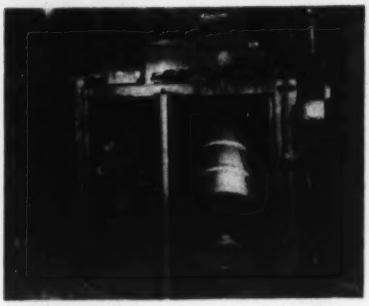
Speed Reducing Units

A new line of variable speed reducers, which are claimed by the manufacturer to be the lowest cost units on the market, has been announced by the New Standard Div., U. S. Expansion Bolt Co., York, Pa. Called "Men-E-Uses" the new speed reducers feature extreme versatility which provides users with quick speed selections of variable speeds from 1 to 750 rpm. Available in two sizes, the new units meet power drive requirements of all 1/4 to 2 hp motors.

"Men-E-Uses" Model 1 provides speeds from 20 to 750 rpm and will sell for $29.; Model 2 produces speeds from 1 to 150 rpm and will sell for $68.

UHF Converter Refined

A revised Model LCU-A UHF converter is announced by Granco Products Inc., 36-17 20th Ave., Long Island City 5, N. Y. Two control knobs—one for the selector-power switch and the other for high-ratio finger-tip tuning—are retained, together with slide-rule tuning dial set off by the corduroy motif backdrop. Working details include the unique Granco two-cavity coaxial tuner which covers the entire UHF band continuously, with the lowest noise figure of any converter in its price class.



Drum Cleaning Machine

A new airless abrasive blasting machine for the reconditioning cleaning of 30 and 55 gal steel drums before painting and coating operations is announced by American Wheelabrator & Equipment Corp., Mishawaka, Ind. It handles the type of drums used for holding chemicals, industrial process materials, foods, oil, gasoline, grease, asphalt, paint, varnish, foundry core binders, plastics, and the like.

The machine is capable of cleaning the exterior surfaces of closed-end drums and both the exterior and interior surfaces of open-end drums, together with the lids. It is equipped with a hydraulically-rotated table with a partition that divides the machine into two compartments or work stations. Each work station consists of two power driven spinner shafts that rotate one drum in the blast zone. Each station also has a fixture for holding the lids in the blast. This arrangement permits one station to be loaded and unloaded while the other is in the blast zone, virtually eliminating all down time.

Cleaning is done by abrasive hurled centrifugally by a rotating bladed wheel mounted in the rear wall of the cabinet, and the spinner shafts are pivoted to enable the position of the drum with respect to the blast to be adjusted, so that either open or closed end drums can be hit at the proper angle by the abrasive.

Continuous-Flow Cleaning Barrels

Pangborn Corp., Hagerstown, Md., has announced the availability of five sizes of type GO continuous-flow Rotoblast cleaning barrels ranging from a 48-in. to a 72-in. diam drum.

The barrels are suited for applications such as a foundry planning a maximum amount of automatic operation. They are then installed so that conveyors bring castings from the shakeout and cooling conveyor directly into the barrel, where they are continuously moved through while being tumbled and blast cleaned. All abrasive is reclaimed before cleaned castings are discharged from the barrel, either onto a conveyor or into tote boxes. Because of their high cleaning capacity, the barrels are best suited to heavy volume cleaning operations.

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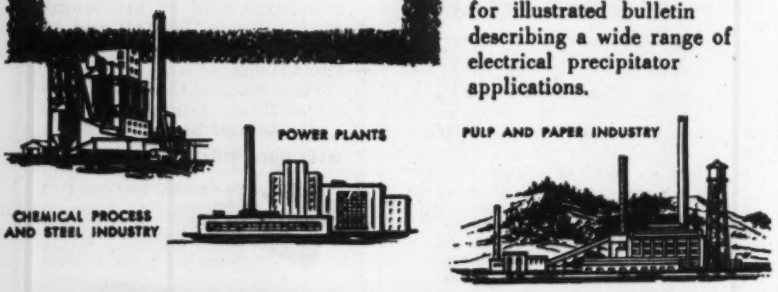

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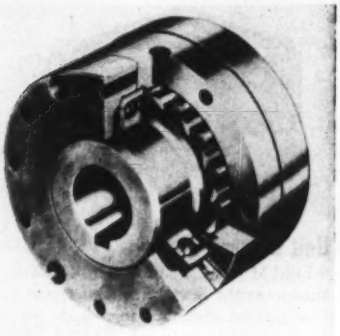


New Cam Clutches

A new line of general duty, heavy duty ball bearing overrunning clutches has been added to its line of standard cam clutches by Morse Chain Co., 7601 Central Ave., Detroit 10, Mich. Called the MC Series these self-contained units include two ball bearings that maintain concentricity of the inner and outer races, thus avoiding the need for additional bearings to support the ends of shafts that the clutches control.

The company claims typical drive applications of the cam clutches, which have alternate low wedge angle cam and roller construction, include high speed overrunning, backstop and heavy duty indexing. They can be used as indexing mechanisms in spring coilers, stock feeds and tire cross grooving machines. Two-speed drives are typical overrunning applications for the clutches.

Tapped holes are provided on both ends of the clutches for cap screws or studs which can attach sprockets, gears, pulleys or ratchet arms for particular drive requirements from 60 to 545 ft-lb.

Remote Indicators & Recorders

Richardson Scale Co., announces the development of remote indicators and recorders that have standard accuracies of one part in 2000. Higher accuracies are available, if desired.

Designed originally for weight control, these remote units precisely follow a prime-mover dial scale. In operation, the weight of material fed to the automatic scale's weigh hopper is indicated on the dial scale. These readings are synchronized and duplicated on an indicator in any chosen remote location.

Remote recordings may be made either on circular charts, strip units or tape printers. Remote indicating and recording units may be hooked up to any industrial-make scale dial, and any number of units may be run by the one prime-mover. Heart of the instrumentation is a 60-cycle servo system developed by Richardson. It consists of a synchro transmitter, amplifier and a servo mechanism made up of a servo motor and control transformer. For additional information, write to Richardson Scale Co., Van Houten Ave., Clifton, N. J.

Double Pitch Chains

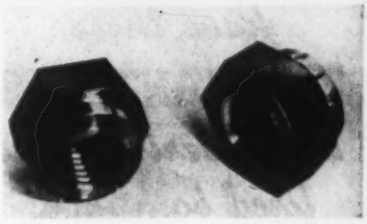
The Diamond Chain Co., Inc., Indianapolis, Ind., announces a complete line of double pitch conveyor and power transmission roller chain. These chains operate over roller chain sprockets. They are dependable, long life mediums for light conveying, materials handling and moderate speed power transmission.

They are called American standard stock chains. Stock attachments are available for the conveyor line.

A catalog, No. 34, is available from the company.

Bronze Chain Pipe Wrenches

Four sizes of the only all-bronze safety chain pipe wrench manufactured in the United States have recently been announced by Ampco Metal, Inc., 1745 S. 38 St., Milwaukee 46, Wis. As an economy feature, the beryllium copper jaw inserts are reversible and interchangeable to give longer improved service and a constant superior gripping ability that minimizes the chances of slippage and personal injury. The entire wrench is Ampco metal with the same properties of being spark-resistant, corrosion-resistant and non-magnetic as the other items of Ampco safety tools.



New Engine Nut

Standard Pressed Steel Co., Jenkintown, Pa., has added a series of engine nuts to its line of Flexloc self-locking locknuts. The new Flexlocs, Series 32FE, are designed for aircraft or automotive engine use where temperatures do not exceed 550 F.

The engine nut is distinguished from the standard Flexloc by an integral metal washer face on the seating side of the nut, the company says. This washer face, a circular collar about $^1/_{32}$ in. thick, can be machined to much closer tolerances than the full seating face of a standard nut.

Squareness of the washer face with the pitch diameter of the nut is held to within 0.005 on sizes through $^7/_{16}$ in. and to within 0.006 on the $^1/_2$ in. diameter nut.

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in pulverized coal fired boilers . . .

They may be installed in practically all types of pulverized coal burners, with these seven important advantages:

- **They warm up cold furnaces**
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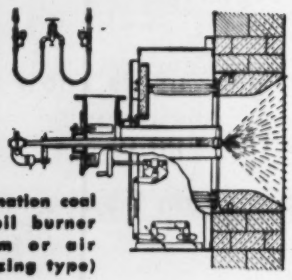
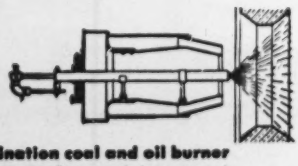
- **They assure continuous operation in case coal system fails**
- **They provide efficient and safe operation on bank and at low loads**
- **They respond almost instantly to sudden load changes**
- **They permit operation with oil or coal—whichever is available and lowest in cost per BTU.**
- **All capacities of steam, air or mechanical-atomizing types are interchangeable**

The foregoing are only a few of the reasons why Enco oil-burners have been bought by a long list of leading industrial firms. Details of how Enco oil-burners can be adapted to your present pulverized coal burners will be gladly supplied—without obligation. Write The Engineer Company, 75 West St., New York, N. Y.



Combination coal and oil burner (Steam or air atomizing type)



Combination coal and oil burner (Mechanical atomizing type)

Enco Burners

Rust Prevention Dispenser

A new, time-saving method of rust prevention, utilizing 12-ounce pressurized, push-button cans, has been announced by E. F. Houghton & Co.

Containing "Rust Veto Spray," these handy dispensers are said to provide a quick, clean, and effective way to apply an even, transparent protective film to metal parts. It is especially handy for protecting small items such as tools, dies, gages, precision parts, hardware, and items being stored, the company says. Further information is available from E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

Develops New Weldrod

In order to meet the need of industries for weldrod to repair nickel-aluminum bronze propellers as-cast and after damage and wear in service, Ampco Metal, Inc. has developed Ampco-Trode 46, which is available as covered electrodes for use with the metal-arc process, covered 36 in. filler rods for carbon-arc welding and bare 36 in. filler rods for inert-gas tungsten-arc welding. The composition of Ampco-Trode 46 is almost identical to the casting alloy which is: aluminum 10.0–11.0 per cent; iron 3.0–6.0 per cent; nickel 3.0–6.0 per cent; and the balance, copper.

Further information may be obtained from Ampco Metal, Inc., 1745 S. 38 St., Milwaukee 46, Wis.

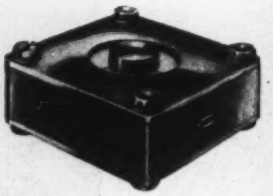
Taper-Lock Sprocket

A new bulletin, A-632, on Taper-Lock sprockets and Dodge roller chain, a supplement to bulletin A-624 is available from Dodge Mfg. Co., Mishawaka, Ind.

Information contained in this four-page bulletin covers latest technical data and prices on all items in the newly extended Taper-Lock line which now includes sprockets and chain for sizes ranging from 40 through 160. The pitch range is from 1/2 through 2 in. It contains tabular data relating to Taper-Lock sprockets in the complete size range, cross section drawings, dimensions, number of teeth, sprocket numbers, bushing numbers, weights, bores, keyseats and list prices. Full information is also given on Dodge roller chain—both riveted and cottered—and roller chain pin extractors.

Sheet Weight Calculator

A new sheet weight calculator is being offered to sheet metal fabricators by Armco Steel Corp. Weights can be quickly determined for many types of special and commodity steel sheets, including coated and uncoated grades, as well as stainless steel sheets and plates and the commonly used non-ferrous metals. On the reverse side of the calculator is a gage, weight and thickness table for stainless steel and hot and cold rolled mild steel sheets, strip and plates. The calculator can be obtained by writing to Marketing Service Dept., Armco Steel Corp., Middletown, Ohio, and enclosing 50 cents in coin to cover printing and mailing costs.



Unit Damper

Lord Mfg. Co., 1635 W. 12th St., Erie, Pa. announces the development of a new vibration damper developed to provide the additional damping required in many vibration control systems. The amount of damping is varied to fit the particular characteristics of the suspension system. This means that application of the new unit damper will reduce the amplitude at resonance, resulting in lower forces being transmitted to the mounted equipment and tending to prolong mounting life, the engineers claim.

The unit damper is designed to provide damping in any direction. It is composed of an unique arrangement of components, the materials and design of which have been chosen for their ability to meet specific requirements, according to the company. All components have been made of material chosen because of their ability to retain their characteristics over a wide range of environmental conditions.

Solenoid Valve

A solenoid valve with built-in protective strainer to provide automatic "on and off" flow control of water, air or gas lines has been announced for use on small flow volume applications by Hays Mfg. Co., 818 W. 12th St., Erie, Pa.

An optional feature is flow volume control, which will maintain one set rate of flow regardless of variable pressure, according to the company. The valve, called "Electro-Mite," is produced with 1/4 in. inlet and 3/8 in. outlet, and 1/4 in. bushings are available for outlet. Both inlet and outlet are 1/4 in. when used with volume control.

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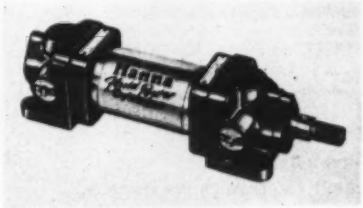
KEEP INFORMED — NEW EQUIPMENT, BUSINESS NOTES, LATEST CATALOGS

Concrete Pipe Machine

A concrete pipe manufacturing machine, completely controlled by a single push-button and operating 60 per cent faster than older type machines, has been announced by Warner Electric Brake and Clutch Co., Beloit, Wis.

The machine manufactures large-diameter concrete pipes such as are used for highway drainage, culverts, dam spillways, special sewer installations, and other large-scale uses. Stepped-up production on the machine is made possible by the use of electric clutches. The clutches perform the work that formerly had to be done by hand by the operator of the machine.

In a recent test, the machine produced 1700 pieces of pipe, all of which were accepted by government inspectors. The rejection rate on older type concrete pipe machines was between 10 and 15 per cent. Maintenance on the new machine, it was explained, has been cut to a minimum through the use of the clutches. In tests, the machine has saved up to 800 man hours per year in maintenance alone.



Fluid Power Cylinders

New fluid power cylinders featuring what company says is unusually large capacity to size ratio have been introduced by Hanna Engineering Works.

The cylinders, identified as the 750 series, were re-designed to produce a more compact cylinder of large capacity with virtually unlimited application and to incorporate a new Hanna cushion design with positive, easy adjustment. They conform to JIC standards. A new catalog is available.

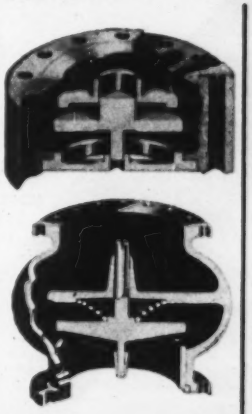
Adds to Fosbond Line

Availability of Fosbond 61, a new product for use in producing a phosphate coating on zinc, has been announced by the Pennsylvania Salt Mfg. Co., 1000 Widener Bldg., Philadelphia 7, Pa.

This phosphatizing compound provides a fine crystalline coating on metal surfaces which serves as an excellent base for subsequent painting operations, the company says. The material is mixed with water and applied by spraying.

Fosbond 61 is an addition to the company's metal processing dept.'s paint-bonding and rust resistant phosphate coatings line. While designed specifically for use on zinc surfaces, the new product may also be used on steel.

For all Piping systems handling . . .



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Send coupon today for your copy of Bulletin 654! This bulletin gives complete details on these dependable Williams-Hager check valves and how they eliminate water hammer and other costly and annoying noises in all types of piping systems. Available in sizes for every service. Renewable working parts. Write today.

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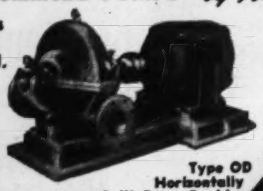
we recommend **PUMPS** *"by Aurora"*



Capacities to 4,000 G.P.M.

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Type OD Horizontally Split Case, Double Suction, Single Stage Centrifugal Pump

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RCA has two engineering management openings in its expanded electronics engineering program:

Manager Missile Guidance Systems Projects (*to supervise circuit development engineering, systems analysis and coordination of design for missile guidance*).

Administrator Mechanical Design (*to coordinate design effort of Engineering Staff for best practical mechanical design*).

These positions require the ability to manage a comprehensive design and development engineering organization and to plan broad engineering programs. Your ability should be substantiated by proven supervisory experience and a degree in EE, ME, or Physics.

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Dept. B-483H, Radio Corporation of America
Camden 2, New Jersey

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RADIO CORPORATION OF AMERICA

KEEP INFORMED — NEW EQUIPMENT BUSINESS NOTES LATEST CATALOGS

Water Conditioner

The Packard Mfg. Co., 2220 W. Beaver St., Jacksonville 9, Fla., announces the marketing of a new water conditioner that eliminates and prevents corrosion and scale formation in boilers and water systems.

The water conditioner prevents scale and corrosion by imparting added energy to the atoms of the water solution. The unit is easily installed. It has no moving parts and requires no expensive maintenance or servicing either in the form of labor or added chemicals. Tests which have been given the conditioner substantiate the theoretical and practical value of the device. The manufacturer lists among its satisfied users companies with installations on boilers, air conditioning and refrigerating systems, dairy and soft drink bottle washing equipment, and other industrial applications.

It is manufactured in sizes handling from 6.5 to 1760 gpm for connection with corresponding standard iron pipe ranging from $^3/_4$ to 12 in.

Dielectric Coating

A resilient dielectric coating or encapsulating material for extreme temperature electric and electronic components has been developed by Dow Corning Corp., Midland, Mich. Identified as Silastic S-2007, the new silicone rubber cures in 2 to 4 hours at 200 C to form a rubberlike jacket which is uniform, heat-stable, moistureproof and highly resistant to oxidation, ozone and weathering.

Tests indicate that transformers properly coated with this new material will easily pass both the moisture resistant and low temperature flexibility requirements of MIL-T-27 grade 1. The engineers claim fully cured coatings also have about twice the thermal conductivity of conventional resin-

ous or rubber dielectrics, assuring cooler operation at high temperatures.

Supplied as a solvent free, low consistency paste, Silastic S-2007 may be applied by dipping, vacuum impregnating, or may be molded in fitted encapsulating molds. Coated parts may be placed directly into a hot air oven for vulcanization. Neither pressure nor a graduated cure is necessary.

Normally white, it may be tinted any shade by the user with heat-stable pigments. Fully cured coatings have a hardness in the range of 40 durometer, Shore A scale. Material cost is comparable to that of standard raw Silastic stocks.

Universal Circuit Chassis

A universal circuit breadboard chassis has been introduced by the Replacement Sales Dept. of the Cathode-Ray Tube Div., Allen B. Du Mont Laboratories, Inc., 750 Bloomfield Ave., Clifton, N. J.

The new unit furnishes the most complete and versatile breadboarding device ever offered to the field of electronic circuit development and experimentation. It and its component parts greatly reduce circuit construction time and accommodate a complete variety of components without the need for a single power tool, the company says. It promotes neat wiring both above and below the chassis, facilitates rapid modifications on circuit components, simplifies circuit layout, and provides 'prototype' wiring for the design of printed circuits.

The new breadboard enables circuit experimenters to construct a "modular" unit in which circuit layout conditions approximate those of actual production.

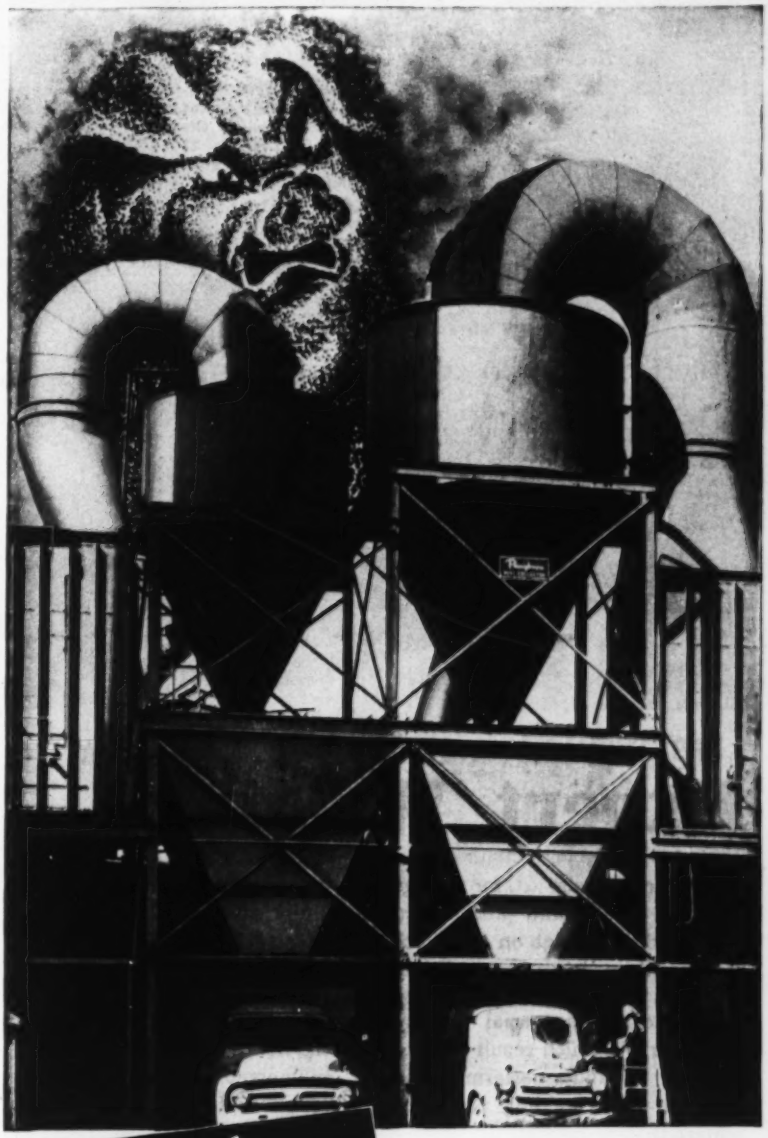
Stall Type Torque Motor

New motors that can be stalled or "locked," with current on, without damage to the motor have been announced by Reuland Electric Co., Alhambra, Calif. The unit automatically adjusts its speed to intermittent load changes, at the same time maintaining a constant power. Typical applications for the new motor include winding film or wire onto spools; closing and holding closed electrical contactors, valves and locking devices; opening and holding open brakes; lifting and holding up cams. Door operators, machine tools and many pump applications are additional uses that take advantage of the unit's unique electrical characteristics.

Reuland torque motors are also ideally suited to tandem installations where another motor sets the pace. An example of this is the winding of scrap as it is being slit from a metal sheet. Ratings are measured in ft lb of torque rather than hp. Standard units from $^1/_2$ through 10 ft lb, with across-the-line locked service duty of 5, 10, 25, 50 and 100 per cent are available. Maximum stalls are 5, 10, 20, 60 minutes and continuous, respectively.

The motors are also available with right-angle worm or Helical gear reducers. Selection chart and other engineering data is available from the company.

PANGBORN **STOPS** THE DUST HOG



Pangborn DUST CONTROL
doubles production

for Henry Chanin Corp., East Point, Ga. — by eliminating daily maintenance down-time. In addition, Pangborn Dust Control holds dust count to well below state health requirements, has cut equipment maintenance costs to the bone, and saved Chanin thousands of dollars in labor costs annually.

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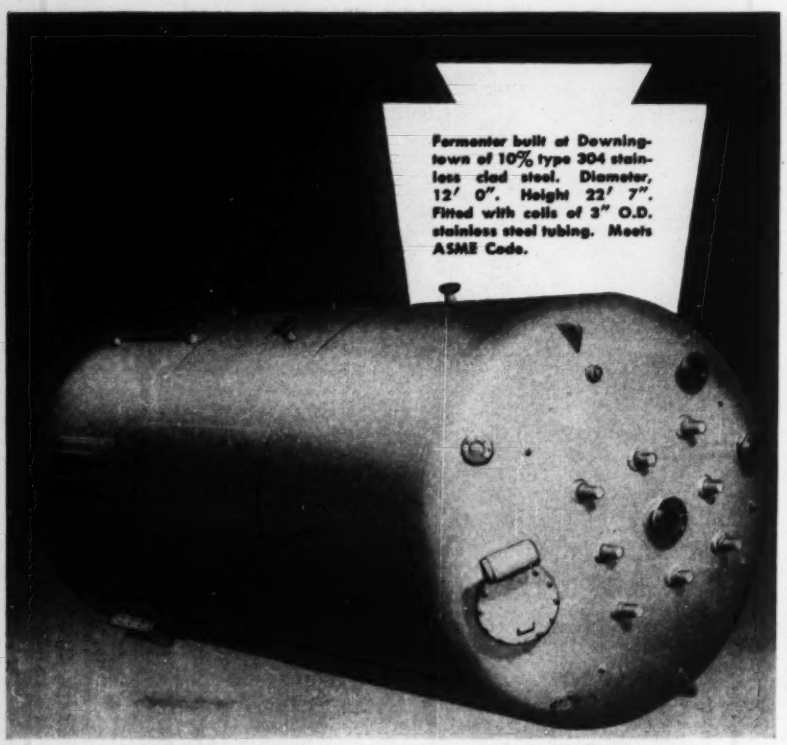
50th Anniversary Medallion

Pangborn engineers will be glad to discuss *your* dust control needs—show you how Pangborn equipment can save you time, trouble, and money. For more information, send for Bulletin 909-A today! Write to: PANGBORN CORPORATION, 2200 Pangborn Blvd., Hagerstown, Maryland.


Fermenter built at Downingtown of 10% type 304 stainless clad steel. Diameter, 12′ 0″. Height 22′ 7″. Fitted with coils of 3″ O.D. stainless steel tubing. Meets ASME Code.

Expert Welding . . .

Check for accuracy . . . for strength . . . for neatness. You'll find that pressure vessels and process equipment fabricated at Downingtown Iron Works rate high on any check list. *Expert Welding* is one of the reasons why. It's a highly developed skill at Downingtown.

We've developed special welding techniques — approved for ASME Code work — which result in sound, strong, neat welds. Experienced welders skillfully perform automatic submerged arc, gas-shielded arc and other welding processes. Welds are X-ray inspected as required.

Downingtown is thoroughly experienced in fabricating various grades of carbon steel, stainless steels, nickel clad, stainless clad, Monel clad, cupro nickel, aluminum, and many other alloys. Write for further information.

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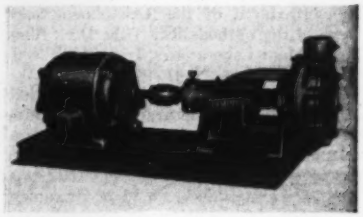
CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS

To Make Teflon Rings

The Mechanical Packing Division of the Flexrock Co. announces the creation of a new department for the molding and machining of packing rings and other small parts from pure Teflon, Teflon combined with other ingredients, shredded lead, shredded aluminum, and a plastic semi-metallic, self-forming, self-lubricating formulation recently developed by the company. The most modern equipment has been installed and investment has been made in molds and dies to produce the customary as well as Teflon "V" rings. Bulletin No. 77 which describes the new products is available from Flexrock Co., Packing Division, 3600-C Filbert St. Philadelphia 1, Pa.



Centrifugal Pump

A centrifugal pump with optional features for specific needs has been announced by The Deming Co., Salem, Ohio. The new end suction centrifugal pump is identified as Deming Fig. 4011 Series. Sizes range from 1 to 5-in. discharge; capacities up to 1000 gpm, maximum heads up to 250 ft. Units can be furnished with electric motor, or for belt drive, or pump only.

Semi-open, non-clogging type impeller has extra heavy, 3-vane construction and axial shaft adjustment are said to be made while pump is running.

Equipment provides for stuffing box construction with lubrication by grease or clear water in lantern ring. For abrasive or corrosive service, a pressurized clear water connection to lantern ring is recommended. A flushing type stuffing box construction is ideal for shaft cooling or high vacuum sealing.

Where required, a mechanical seal construction of double-seal design with pressurized water or grease lubrication is furnished but only with stainless steel shaft. Special seal materials are available for use with most types of corrosive liquids. Information and performance tables are available in Bulletin No. 4011 from the company.

High Temperature Switch

A new precision switch for high-temperature applications is announced by Micro Switch of Freeport, Ill., Division of Minneapolis-Honeywell Regulator Co.

Because of its small size the new switch, designated IHTI, is ideal for high-temperature aircraft applications. Its capacity for switching a substantial electrical load in a temperature range of minus 50 to 1000 F makes it equally well suited for high-temperature industrial applications, such as

those found in vulcanizing plants and other industries which require high-temperature components. Laboratory tests at 700 F show life in excess of 25,000 operations at a resistive load of 5 amp 28 v d-c. At 1000 F the new switch has surpassed 9000 operations carrying a resistive load of 2 amp 28 v d-c.

The switch is designed for panel mounting. Two thin hexagonal nuts and two lock nuts on the threaded bushing permit adjustment of the operating point without removing the switch from its mounting.

Fluid-Coupled Worm Reducer

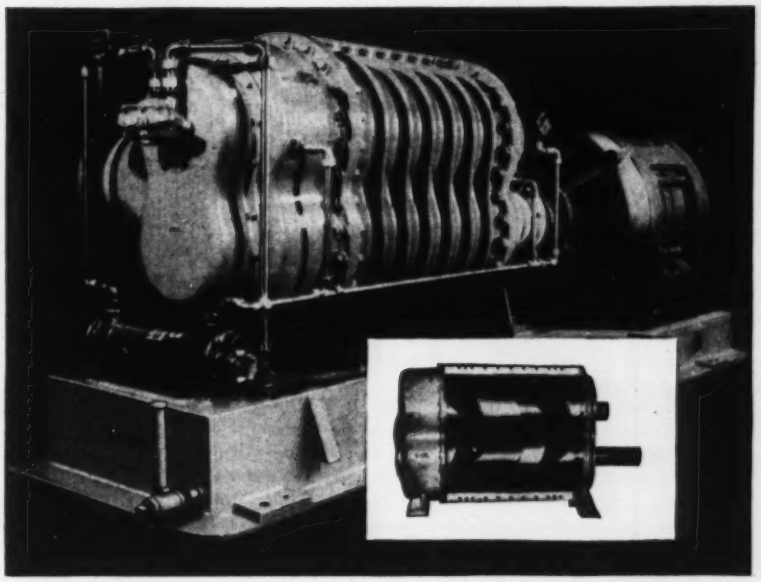
A new fluid-coupled worm reducer which features fluid-cushioned starting in conjunction with a compact, worm type speed reducer has been announced by Reuland Electric Co., Alhambra, Calif. It is especially adapted to powering loads that require smooth, gradual acceleration such as mixers, conveyors, centrifugals and cranes.

The unit is said to provide unusual compactness in comparison to helical gear reducers and to have increased mounting versatility (16 different positions). They are available in the following horsepower ratings and frame sizes: 1/3 and 1/2 hp., 66W frame; 3/4 and 1 hp, 204W frame; 1 1/2 hp, 225W frame; 2 hp, 254W frame. Speed reductions from 24 rpm through 140 rpm are offered. Units can be ring or foot mounted.

Sintered Metal Parts

The Powder Metal Division of the Bassick Co., Bridgeport 2, Conn., announces its third facilities expansion, designed to increase production by 50 per cent.

Bassick now offers "custom-made" precision parts to industry. Prices on rollers and wheels range from 3¢ to 30¢ per part, depending upon size, quantity and metal requirement. Iron base and brass rollers and wheels can be made as large as 3 in. diam by 2 in. hub length, with bore sizes to suit. Finished parts are precise and have mechanical strength and physical properties comparable to those of machined parts. Further information can be obtained by writing for Bulletin SM-54.



Wide range of pressures and capacities add new opportunities for economy with R-C SPIRAXIAL COMPRESSORS

The 10 sizes now available in the new Roots-Connersville SPIRAXIAL COMPRESSORS provide a capacity range from 700 cfm to 5,000 cfm, with pressures from 15 psi to 30 psi, in single-stage units. Where greater air volumes are required, multi-stage installations are completely practical. The result is that the amazing efficiency and economy of this latest R-C development can be utilized in many applications not fitted to the earlier SPIRAXIAL machines.

Already, users of R-C SPIRAXIALS are profiting from these outstanding advantages:

1. **No internal lubrication—hence oil-free air**
2. **Peak efficiencies at required pressures**
3. **Direct-connected for speeds of 1750 rpm and 3550 rpm**
4. **Uncooled—requiring no water-jacketing**
5. **Small space . . . low noise level**

If you are planning new installations, we suggest a study of the possible economies of R-C SPIRAXIALS. Or, it may well be that SPIRAXIALS will pay for themselves as replacements for present less efficient equipment.

Ask for details in Bulletin SC-253, or for an analysis of your needs by R-C engineers.

1854 1954

ROOTS-CONNERSVILLE BLOWER

A DIVISION OF DRESSER INDUSTRIES, INC.
854 Michigan Ave. • Connersville, Indiana

ROOTS R C CONNERSVILLE SINCE 1854

WORK ON THE FRONT LINE OF THE NATION'S VITAL DEFENSE PROGRAM. Sandia Corporation is engaged in the development and production of atomic weapons—a challenging new field that offers opportunities in research and development to men with Bachelor's or advanced degrees, with or without applicable experience. Here you can work with able colleagues, eminent consultants and superior facilities on advanced projects of high importance — and also build a permanent career in a rapidly expanding field with a company that recognizes individual ability and initiative.

LIVE IN ALBUQUERQUE, THE HEART OF THE SUNNY SOUTHWEST. Located in the historic Rio Grande Valley at the foot of the Sandia Mountains, mile-high Albuquerque is famous for its climate—mild, dry and sunny the year around. A modern, cosmopolitan city of 150,000, Albuquerque offers unique advantages as a place in which to live. Albuquerque's schools, churches, theaters, parks, and modern shopping facilities afford advantages of metropolitan life—yet hunting, fishing, skiing and a multitude of scenic and historic attractions may all be found within a few hours' drive of the city. New residents have little difficulty in obtaining adequate housing.

ENJOY THESE OTHER IMPORTANT ADVANTAGES. These are permanent positions with Sandia Corporation, a subsidiary of the Western Electric Company, which operates Sandia Laboratory under contract with the Atomic Energy Commission. Working conditions are excellent, and salaries are commensurate with qualifications. Liberal employee benefits include paid vacations, sickness benefits, group life insurance, and a contributory retirement plan. This is not a Civil Service appointment.

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New Corrosion Protection

A new addition to its line of volatile corrosion inhibitors, VPI-250, has been announced by the Shell Oil Co., 50 W. 50th St, New York 20, N. Y. Portions of this crystalline amine nitrite compound volatilize very rapidly and will prevent rust almost immediately. At the same time, some of its constituents evaporate more slowly, for longer-lasting protection.

In addition to offering quicker yet longer rust prevention, the new material also flows more freely than any available heretofore. VPI-250, a white powder about as fine as talcum, will not clog a flocking gun, and can easily be applied with a squeeze bottle, a salt shaker, or any similar device. Where spraying or dusting of the VPI is impractical, the powder may be dissolved in alcohol and applied in solution.

VPI-250 does not have to be applied directly to the surface it is to protect. If a quantity of the powder is simply dropped into an enclosed space, its vapors will penetrate even into hard-to-reach areas and condense on all surfaces. The minute crystalline film of VPI does not have to be removed from equipment before it is placed into operation. Only small quantities of the material are required for complete protection in shipment or storage, or between successive processing steps. Small items, such as tools, can be removed from a VPI protected atmosphere, used, and then replaced without the need for any additional rust-preventive measures.

Shaft Mounted Speed Reducers

Shaft mounted speed reducers offering operating advantages said to be possible only with double-enveloping worm gearing are now available from Cone-Drive Gears, Division of Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich. The right angle between input and output shafts offers many application and space saving advantages, the company says. The reducer is mounted directly on the driven shaft and requires only a simple bracket or torque arm to prevent it from rotating about the driven shaft.

Where a motorized reducer is desired, a bell housing can be furnished to accommodate standard NEMA C-type flanged motors. The need for expensive couplings is said to be eliminated because a tang-type drive sleeve and suitably machined worms are provided with the bell housing to match the motor shaft being used. When a shaft mounted speed reducer and flange mounted motor are used, no bed plate or mounting arrangement is required.

The new Cone-Drive right angle reducers are being manufactured in three sizes: 2-in., $2\frac{1}{2}$-in., and 3-in. center distance, and can be furnished in pinion under, pinion over or vertical shaft models.

Reduction ratios for the 2-in. and $2\frac{1}{2}$-in. center distance reducers are from 5:1 to 50:1; for 3-in. models, the ratios range from 5:1 to 60:1. When the motor is connected to the input shaft by means of V-belts and

sheaves, additional output speed reduction can be secured.

Bore sizes for the 2-in. unit range from 1 in. through $1^3/_8$ in. in $^1/_{16}$ in. steps; the $2^1/_2$-in. reducer bore sizes range from 1 in. through 2 in. in steps of $^1/_{16}$ in., and the 3-in. can be supplied with bores ranging from $1^3/_{16}$ in. through $2^1/_2$ in. in steps of $^1/_{16}$ in.

Pneumatic Transmitter

Pneumatic telemetering and control systems are said to be simplified by the use of a pneumatic transmitter, now available from Bailey Meter Co., for transmitting measurements of flow, level, pressure, temperature, draft, differential, and vacuum.

The measuring element actuates the transmitter's micro-sensitive vane, nozzle, and booster assembly. Transmitted signals of 3–15 and 3–27 psig may actuate pneumatic receivers and/or controllers. Both the measured variable and pneumatic signal are indicated on a common scale for easy checking and comparison.

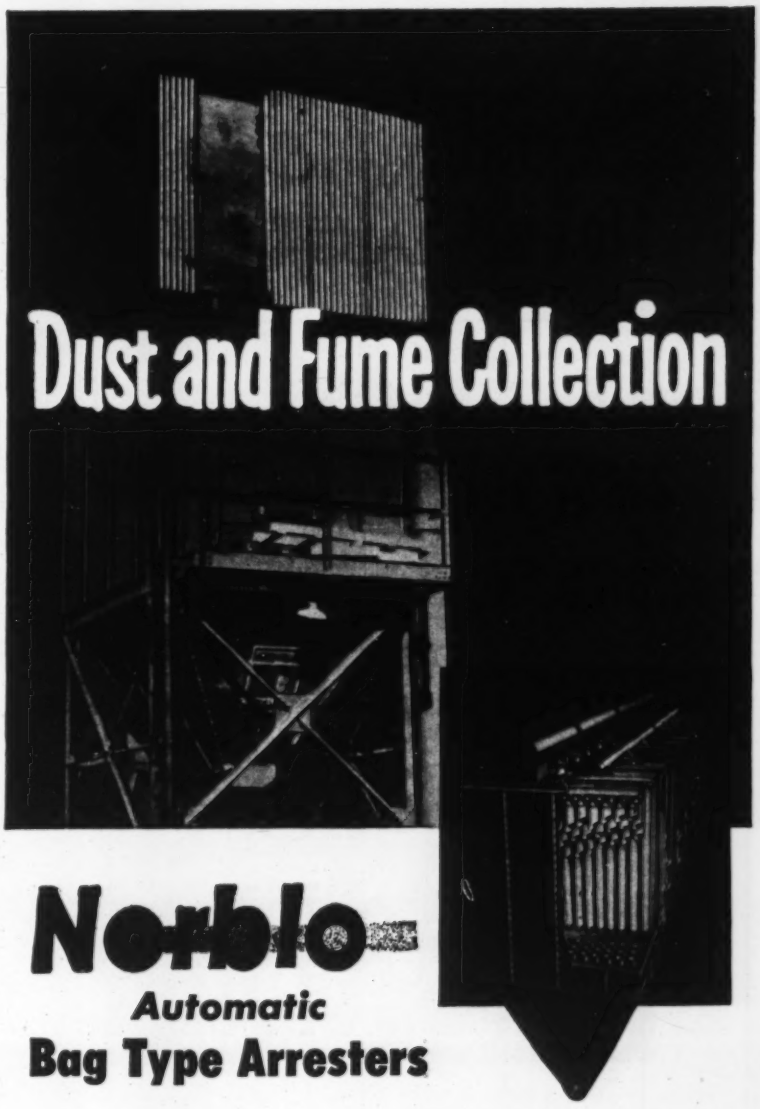
The unit is approximately 8 in. × 10 in. × $3^1/_2$ in. The casing is weather, vibration and corrosion resistant. Transmitting distances can be 1000 ft to receivers, 400 ft to controllers. Accuracy is within $\pm^1/_2$ per cent of measured range span, and air consumption is less than 0.15 cfm. Capacity is approximately 3 cfm with a drop of 1 psig from a signal of 15 psig. Literature is available from Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland 10, Ohio.

Water Treatment Plant

A compact and completely integrated package-type water treatment plant for economy-minded smaller communities is now offered by Graver Water Conditioning Co. It is said to integrate all equipment from inlet to outlet, including the clearwell, chlorinator, wet or dry chemical feeders and proportioners, gravity or pressure filters, recarbonator when required, level and flow controls and instruments, and interconnecting piping. Standard layouts for the complete package plant are available in a wide selection of capacities from 0.1 to 2.0 MGD. Special layouts are available for larger capacities.

Heart of the plant is the Graver Reactivator, a cold-process water treating unit used for selective or simultaneous removal of turbidity, color, and organic matter; taste and odor; iron and manganese; and hardness, from water supplies. It is a self-contained, high rate unit of the solids-contact type, embodying within a single compartmented tank all the established functions of coagulation, flocculation, sedimentation, and sludge removal that, in conventional plants, are performed in separate tanks. The integration of these functions within a single tank is said to be an important space-saving feature.

In the reactivator, the treatment is carried out with such efficiency that the detention-time is only 60 to 90 min. instead of the normal 3 to 6 hr.



Norblo equipment is based on sound, experienced engineering and takes full account of the *scale* of your operation as well as *time* factors, so that Norblo performance can be *guaranteed.*

Norblo arrester design is based on multiples of a basic, standardized compartment. Bag cleaning—fully automatic—is cyclic and periodic, taking only a few seconds for each compartment. In continuous, heavy duty operation, full calculated capacity of Norblo equipment is always available, and investment for equipment of any desired capacity is held to a minimum.

Norblo gives you all four essentials of low cost operation for years to come—advanced design, high efficiency, long life and low maintenance. Write for Bulletin 164-4.

The Northern Blower Company
Engineered Dust Collection Systems for All Industries
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mechanical engineers

KEEP IN STEP WITH THE TIMES in PHILADELPHIA

"Progress" is the key word in this exposition. The latest products, trends and techniques in power development, and use are readily available for your first-hand inspection at the Power Show in Philadelphia.

You will want to see the newest developments in mechanical, steam, electrical, hydraulic and pneumatic power equipment to take home some of the ideas which can be money makers for you.

Nearly 300 of the nation's leading manufacturers of power and allied equipment are anxious to show you the results of their research, so don't miss the opportunity to compare competitive products and adapt the best to your plant operation.

It's an easy way to keep *ahead.*

PLAN NOW TO SEE THE POWER SHOW

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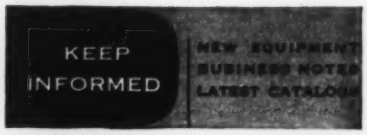
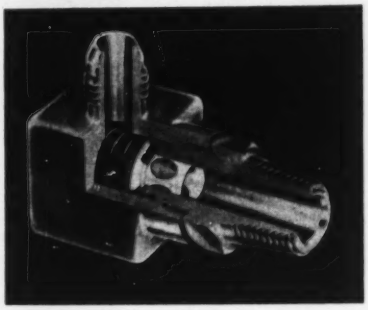




Right-Angle Check Valve

The configuration of the P-602 right angle check valve has been developed by James-Pond-Clark, 2181 E. Foothill Blvd., Pasadena 8, Calif., to answer the need for a valve having all of the characteristics of the company's standard inline 200 series, but which must fit into a system in a limited space. The same quiet, chatter free, zero leakage design principles used in other circle seal valves have been applied to the new design valve.

It is also said that the right angle design will frequently simplify line arrangement and facilitate installation, with a resulting reduction in over-all cost.

Portable Extensometer Comparator

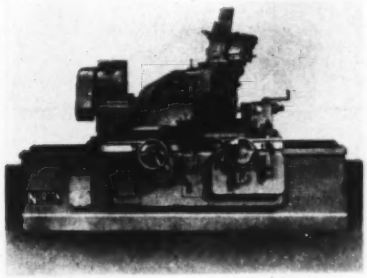
The first portable extensometer comparator, an instrument for calibrating extensometers, compressometers, dial gages, and similar devices is announced in Bulletin 4210 by Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa. The microformer principle of measurement and method of calibration are described.

Traveling-Wave Amplifiers

Two new traveling-wave amplifiers offered by Hewlett-Packard provide 30 and 35 db gain over the 2000 to 4000 mc band. The amplifiers are said to feature low noise amplification, a full watt of power output, and millimicrosecond pulsing over a full 2000 mc frequency spectrum. They are characterized by a distinctly new coupled helix design which has no mechanical connection between the outer circuitry and the inner tube helix, although a full transfer of energy is effected. The simplicity of this new design permits amplifier units to be compact, sturdy and portable, according to

the company. Tubes may be conveniently replaced, and the original and replacement traveling-wave tubes are completely capsulated and adjusted prior to installation in the amplifier.

Model 490A traveling-wave amplifier is used for all types of high gain, broad band, low noise amplification. Its 35 db of amplification is said to be useful with receivers, detectors and improving the sensitivity of waveguide and coaxial measurement systems. Model 491A provides a full watt of power output for high level measurements and may be connected to a signal generator of 1 mw output to deliver a full watt of power over the 2 kmc to 4 kmc range for antenna measurements, attenuation measurements, impedance measurements. Both amplifiers are priced at $1100.00 f.o.b. factory. Operating details and specifications are available from Hewlett-Packard Co., Dept. P, 395 Page Mill Rd., Palo Alto, Calif.



Announcement of New Grinding Machine

Norton Co., Worcester 6, Mass., announces its new Type CV-4 semiautomatic angular wheel slide grinding machine to replace the Type C angular machine.

The CV-4 angular machine rapidly grinds thrust surfaces and adjacent diameters simultaneously in a single, automatically controlled plunge grind, the company says, cutting grinding costs by eliminating the separate operation normally necessary when similar jobs are done in conventional cylindrical grinders. The machine is said to produce a concentric grain pattern in the finish of the shoulder or thrust surface ground.

Fast, accurate sizing is said to come from the feeding efficiency of the Norton CTU type wheel feed mechanism with a hydraulically rotated, micrometer-screw feed. This mechanism also includes a "click-count" index with which settings for work diameter reduction in increments as fine as .0001 in. can be made.

The Type CV-4 machine is available in 10 in. and 14 in. swings, and in 36 in., 48 in. or 72 in. work lengths in either swing. In addition to hydraulic power table drive, an auxiliary hand drive mechanism is provided. When wheel guard truing is installed, the hand table drive only is provided, since the primary purpose of the hydraulic table drive is for truing.

What's NEW in pumps from PEERLESS PUMPS ?

NEW VERTICAL MULTI-STAGE PUMP — the Peerless Hydro-Line — now available in both process and transfer types — for process liquids and water.

And the BIG REASON for its existence and acceptance is a matter of NPSH—*net positive suction head*. This feature of the Peerless Hydro-Line pump is particularly important where installation on existing systems permits operating on the minimum available NPSH without costly changes to system piping. The Hydro-Line offers the optional selection of mechanical shaft seal or packing gland construction. Pump bowls and impeller are equipped with wear rings, a design feature not regularly available in this type of pump. Spacer type motor shaft coupling permits easy removal of driver for inspection and repair of pump if required. Add to these Hydro-Line features the advantages of the elimination of expensive sump construction,—Hydro-Line is an encased barrel type pump, its space-saving vertical design, the relatively easy addition or subtraction of bowl units to meet future plant demands, its easy removal to new location, *plus* ample capacity up to 5000 gpm and a wide head range up to 1000 feet, the maintained high efficiencies of Hydro-Line's design and its profitable application to in-the-line pumping is readily apparent.

MAIL COUPON FOR COMPLETE INFORMATION

A New 4-color Bulletin completely describes and illustrates the Peerless Hydro-Line pumps. Request your copy by mailing coupon at right.

PEERLESS PUMP DIVISION
Food Machinery and Chemical Corp.
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Offices: New York; Indianapolis; Chicago; St. Louis; Atlanta; Dallas, Plainview and Lubbock, Texas; Albuquerque; Phoenix; Fresno; Los Angeles.

PEERLESS PUMP DIVISION
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What do YOU know about the vectored slipstream principle?

If you are one of a select group of men that can offer valuable contributions to its application and effects, why not look into Fairchild's career opportunities?

You probably know that Fairchild is now producing the C-123 *Avitruc*, as well as the world-famous C-119 *Flying Boxcar*. But did you know that reconnaissance aircraft . . . jet fighters . . . and jet bombers and transports are on the drawing boards too? These diversified, stimulating assignments increase the inventive challenge to Fairchild's team of qualified aerodynamicists.

Gracious country living only minutes away from urban Baltimore or Washington . . . paid pension plan . . . an excellent salary with paid vacations . . . an ideal working environment . . . generous health, hospitalization and life insurance . . . and the many other benefits of a progressive company add to the pleasure of working with Fairchild.

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KEEP INFORMED — NEW EQUIPMENT · BUSINESS NOTES · LATEST CATALOGS

Flexible Oil Hose

A new lightweight, flexible oil hose for use in loading and unloading tankers and barges and other dockside operations has been developed by the mechanical goods division, United States Rubber Co., Rockefeller Center, New York 20, N. Y. The new hose, which uses lightweight steel nipples, is one-third the weight of conventional types. Further savings in weight can be achieved through the use of aluminum flanges. The hose is called Amazon oil discharge hose (H-1515).

Although it has a working pressure of 200 psi and a safety factor five times as great, the hose can be bent and kinked without damage and instantly springs back to shape, the company added. It is exceptionally adaptable to bunkering service and is available in sizes ranging from 3 to 12 in. ID. Its neoprene tube and cover make it oil resistant and give it good resistance to aging and the damaging effect of sunlight.

BUSINESS NOTES

To Move Power Pump Operation

Worthington Corp. is moving its entire reciprocating power pump operation now handled at the Harrison, N. J., Works, to its Oil City, Pa., plant.

Involved in the transfer are the engineering, manufacturing, sales and parts replacement programs. Greater space available at Oil City plus the technical experience and ability of Oil City Works' personnel in the manufacture of reciprocating power pumps were factors considered in the decisions to relocate the operation. Improvements in delivery and service are anticipated because of proximity to oil field and industrial hydraulic markets from the new location. Reciprocating steam pumps will continue to be manufactured at Harrison Works.

Appoints Sales Representative

Adamas Carbide Corp., of Kenilworth, N. J., manufacturers of standard carbide tools, tool tips, dies and wear parts, has announced the appointment of Production Tooling Service, 411 N. 23rd St., Birmingham, Ala., as its sales representative for the states of Alabama and Tennessee.

Purchases Crane Business

The Wellman Engineering Co., 7000 Central Ave., Cleveland 4, Ohio, has purchased the locomotive crane business of the Browning Crane and Shovel Co. This acquisition brings to Wellman an outstanding addition to its line of heavy-duty materials handling equipment. The locomotive crane organization will be known as the Wellman-Browning Locomotive Crane Division of The Wellman Engineering Co. with headquarters at 7000 Central Ave., Cleveland 4, Ohio.

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Thread Advisory Service

A new service offering free advice to companies having problems with screw thread fastenings has been made available by Heli-Coil Corp., 1502 Shelter Rock Lane, Danbury, Conn. It is called the Thread Engineering Advisory Service.

Experienced engineers are available for consultation on problems pertaining to: tapped thread strengths in brittle metals, light metals, plastics or wood; space limitations caused by tight design specifications; frictional wear on threads subject to frequent disassembly; weight requirements set by high performance goals; vibration wear on threads subject to extreme oscillation; corrosion resistance of threads subject to high humidity or reactive atmospheres; and thread deterioration caused by high temperatures.

An analysis of the problem including controlled tests in the Heli-Coil research and development laboratory, when these are necessary, will be made without obligation. Reports based on these studies, including recommendations as to the most effective and economical solution to the problem, will be submitted to the inquirer.

New Sales Representative

The Fielden Instrument Division of Robertshaw-Fulton Controls Co. has named Equipment Sales Corp. as its sales representative for the Eastern Tennessee area with headquarters in Kingsport. It will include Chattanooga, Knoxville, Oak Ridge and Nashville in its area.

Plans West Coast Office

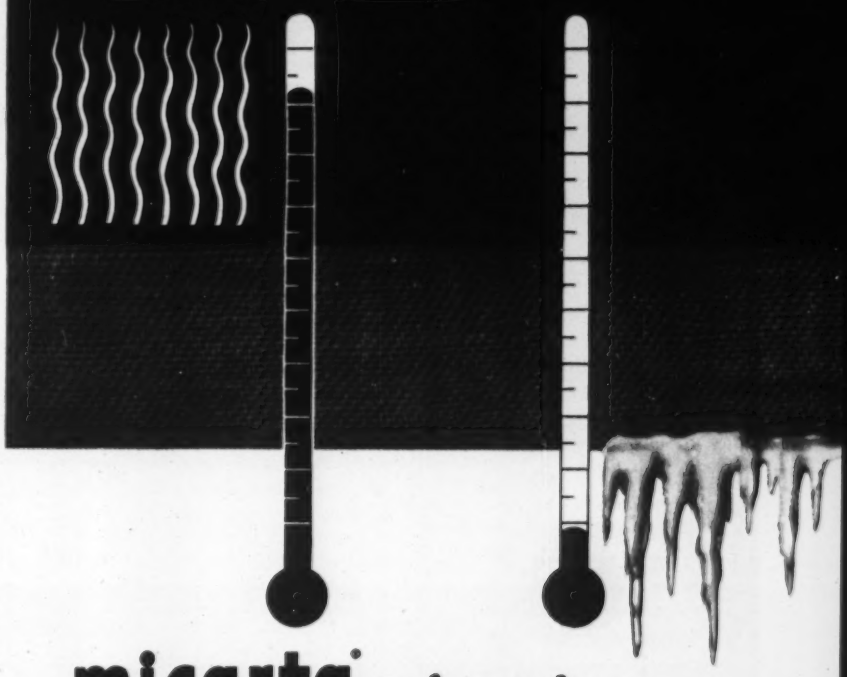
Resistoflex Corp., Belleville, N. J., is opening a new office and assembly station in California. This step is being taken to help provide initial quantities of the company's new light-weight, heat and corrosion-proof hose and hose assemblies known as "Fluoroflex-T" R500 and R3800 to the West Coast aircraft industry. The new quarters will be at 4414 W. Jefferson St., Los Angeles 16, Calif., and will include equipment for supplying test and small production quantities of these materials for immediate needs.

Ferro Purchases Louthan Co.

Ferro Corp., has announced the purchase of the Louthan Mfg. Co., East Liverpool, Ohio, from Harbison-Walker Refractories Co., Pittsburgh, Pa., a transaction which was approved by the Ferro Board of Directors at their meeting of April 30, 1954. Harry T. Marks, administrative vice president of Ferro, will be the new president of Louthan division and Charles W. Gerster will be executive vice president and general manager.

The new Louthan division will produce electrical porcelain insulators, refractory specialties for firing pottery and for the foundry field, and other ceramic products. These will supplement the manufacturing activities of Ferro's division at Crooksville, Ohio, the Ceramic Supply Co.

When you're looking for a material that resists TEMPERATURE EXTREMES...



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MICARTA's Unique Properties are serving every industry in applications ranging from tiny punched parts to massive steel mill bearings.

Westinghouse Electric Corporation, Trafford, Pa.
MICARTA Division, Attention: L. A. Pedley

Sir: (Please check one)

☐ Please have your representative call

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When the job demands precision

dimensional accuracy

– there's no substitute for MYCALEX® glass-bonded mica insulation

The coil form shown in this RCA-Victor [illegible] coil is injection-molded of MYCALEX 410 glass bonded mica insulation. The coil, operated at approximately [illegible] rpm, is subject to high start and stop stresses. The winding contacts a traveling wire that operates at high potential and high frequency. MYCALEX was selected for this application after careful evaluation. The extreme dimensional accuracy, obtainable with MYCALEX glass-bonded mica, the unique ceramoplastic insures perfect centering and at the same time eliminates balance problems. High dimensional accuracy also affords absolute uniformity of parts, facilitating assembly and replacement. The excellent dielectric properties of MYCALEX insure efficient electrical performance.

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- IMMUNITY TO REPEATED ARCING
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Note: MYCALEX 410 glass bonded mica, described above, is an exclusive formulation of, and manufactured only by, the Mycalex Corporation of America. It meets all the requirements for Grade L-48 under Joint Army-Navy Specifications JAN-I-10.

For similar economical solutions to your problems phone or write J. M. DuBois, Vice President-Engineering at the Clifton, N. J. address below.

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KEEP INFORMED — NEW EQUIPMENT, BUSINESS NOTES, LATEST CATALOGS

H. K. Porter Co. Acquires Pioneer

H. K. Porter Co., Inc., Pittsburgh, Pa., announces acquisition of Pioneer Rubber Mills, Inc., of Pittsburg, Calif., manufacturer of industrial rubber products. The new acquisition will become part of the Quaker Rubber Corp., one of the company's nine divisions. The Pioneer plant is the fifteenth factory in the Porter group.

European Subsidiary

The Watson-Stillman Co., Div. of H. K. Porter Co., Inc., has established sales, service, and manufacturing facilities in Holland through a wholly owned subsidiary. At the same time, A. B. Diss, vice president and general manager of the Roselle, N. J., firm, manufacturers of hydraulic machinery, announced a stepped-up program of plant improvement. The new foreign company, Watson-Stillman Internationale Maatschappij, N. V. is located in Rotterdam. Manufacturing facilities have been established with N. V. Machinefabriek "Breda," formerly Backer en Rueb, of Breda, Netherlands. "Breda" will manufacture a complete line of Watson-Stillman hydraulic machinery for the plastics, metalworking, extrusion, railroad, and general industries.

Steel Improvement Champion Forge Division

The Steel Improvement & Forge Co. has purchased the Champion Forge division of Champion Industries, Inc. The Champion plant is located at 3685 E. 78 St. in Cleveland, Ohio. This acquisition makes Steel Improvement & Forge Co. one of the largest commercial forge shops in the United States.

The company now can forge the complete range of sizes needed for the components used in manufacturing aircraft engines, airframes, and airplane landing gear. Large forging weighing as much as a ton can be forged on the huge 35,000 lb. steam hammers at Champion, as well as tiny precision forged compressor blades for jet engines, which weigh less than 1 lb.

Additional Opportunities are offered in the display advertisements— on pages

47, 48, 52, 56, 98, 116, 117

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Moves to Larger Quarters

The Cincinnati district office of Bailey Meter Co., Cleveland, Ohio, manufacturers of industrial instruments and automatic control equipment, has moved to larger quarters at 2330 Victory Pkwy, Cincinnati 6, Ohio. The Cincinnati district territory includes southern Ohio, the central and western sections of West Virginia, southwestern Virginia, Kentucky, and southeastern Indiana.

Representatives Named

Cleaver-Brooks Co., 326 E. Keefe Ave., Milwaukee 12, Wis., announces the appointment of Lefler Wyomont Supply Co., Billings, Mont., as exclusive manufacturers' representative in Montana, Lemhi county, Idaho and northern Wyoming; and Chas. R. Carey, 247 Conner Ave., Knoxville, Tenn., exclusive manufacturers' representative for northeastern Tennessee and western counties of Virginia, for the company's self-contained boiler equipment.

LATEST CATALOGS

Fluorothene Booklet

Recent property and fabrication data on Bakelite fluorothene resins is compiled in a new 16-page booklet published by Bakelite Co. The booklet, called "Bakelite Fluorothene Resins—Properties, Forms, Fabrication," presents a digest of the latest information about these resins in graphs, tables and text. Recommendations on extrusion, injection and compression molding of Bakelite fluorothene resins are included in a section on fabrication. Applications of the resins include monofilaments for the textile industry, extruded insulation for wires and cables, and numerous molded products where advantage can be taken of the outstanding properties of these resins. Copies of the booklet may be obtained from Bakelite Co., a Division of Union Carbide and Carbon Corp., 300 Madison Ave., New York 17, N. Y.

Silicon Transistor Bulletins

Descriptive literature on the first commercially available silicon transistors is announced by Texas Instruments Inc., 6000 Lemmon Ave., Dallas 9, Tex. Bulletins are available on both the types 900 and 901 general purpose silicon transistors and the X-15 medium power silicon transistor. The company says silicon transistors offer higher power outputs and more independence from ambient temperatures than their germanium counterparts.

The silicon transistors will operate up to 150 C, with current amplification factor (Alpha) being essentially independent of temperature change. The X-15 is conservatively rated at 1 watt power dissipation. All three production types of silicon transistors are n-p-n grown junction units manufactured with glass-to-metal hermetic sealing.

Mr. I. O. Johnson of our engineering staff, specialist in bellows applications.

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bellows information you can use!

● He'll help make your design plans more efficient—wherever bellows or bellows assemblies are used. He'll know the kind of metal that will do the best job for you—stainless steel, brass, monel or nickel. He'll recommend the correct bellows charge—volatile liquid or gas. He'll work with you on determining the type of ends needed . . . frequency of operation . . . minimum life required and other important factors. You'll be assured of a bellows assembly exactly suited to your product plans.

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Let our engineers help you—and let our half-century of experience and ample production facilities increase your savings in time, trouble and money. Write today for full information.

SEND FOR FREE BULLETIN

Write for your free copy of an idea-filled bulletin that tells you all about metal bellows and bellows assemblies. Ask for Catalog PK-1400.

Robertshaw-Fulton

CONTROLS COMPANY

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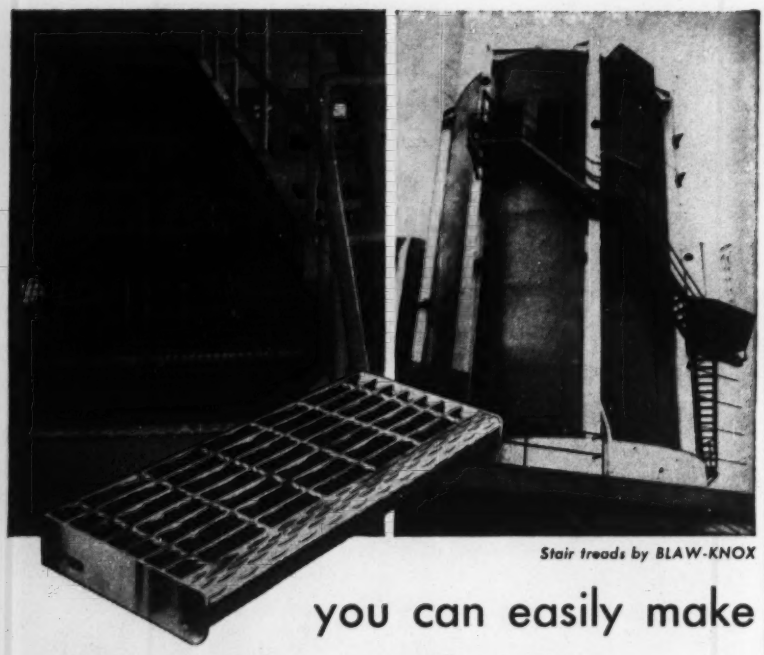


Stair treads by BLAW-KNOX

you can easily make

every step a safe step

Indoor or outdoor, you can rely on Blaw-Knox Stair Treads to provide the safety you want in your plant.

Designed for tremendous strength against impact, these stair treads are made with twisted cross bars and rolled diamond checkered plate nosing—as illustrated.

But, when desired, you can get treads with a twisted cross bar nosing or an abrasive nosing. And for specially slippery conditions we can supply you with serrated cross bar treads.

Just tell us what your application is and we'll offer our recommendations as to the best type of tread for your job.

Only Blaw-Knox Electroforged® Steel Grating and Stair Treads —have these five exclusive features:

1. rigid one-piece construction—easy to install
2. all surfaces accessible—easy to paint
3. no sharp corners to clog—self-cleaning
4. maximum open area—for light and ventilation
5. non-slip twisted crossbar—safe footing

A short note will bring you a copy of new Bulletin No. 2365-R —a dimensional sketch will bring you a quotation.

BLAW-KNOX

BLAW-KNOX COMPANY
2105 Farmers Bank Building • Pittsburgh 22, Pa.

BLAW-KNOX EQUIPMENT DIVISION
GRATING DEPARTMENT

GRATING APPLICATIONS: floors • platforms • walkways • catwalks • stair treads • fan guards • shelving • and many other uses, both outdoors and indoors, for versatile steel grating.

Film on Mechanical Engineers

A new 16mm sound motion picture in color, "Mechanical Engineering at Du Pont," designed especially for college audiences, has been produced by the Du Pont Co. Prints are now available on loan for showings to college groups, engineering societies, and other interested organizations.

The film, which shows mechanical engineering graduates at work in many phases of Du Pont's operations, emphasizes the important role played by the mechanical engineer in a chemical company. It points up the fact that the chemical industry as a whole is heavily dependent on the mechanical engineer for the design and development of new equipment and the layout of new plants.

Scenes in the motion picture, taken at several Du Pont plants and laboratories, portray typical work undertaken by mechanical engineers and highlight the many opportunities available to these graduates in the company. Challenging problems are outlined which cover research, development, production supervision and plant engineering.

The film runs 22 minutes. It is loaned without charge. Prints may be ordered by writing Motion Picture Distribution Section, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

Space Heater Oil-Fired

Bulletin No. 550, issued by Dravo Corp., Pittsburgh, Pa., and obtainable on request, describes the company's Paraflo oil-fired, warm-air space heater, which is available in two capacities: 200,000 and 250,000 Btu per hr.

Mud Valve Catalog

A new catalog and price list covering the new 2000 psi WP (4000 psi test) as well as the 3000 psi WP (6000 psi test) mudline valve is now available from Edward Valves, Inc., subsidiary of Rockwell Mfg. Co., 1350 W. 145th St., East Chicago, Ind.

The new mud valve is an addition to the Mudwonder line introduced to oil drilling industry in March after undergoing 21 months testing on rigs in Oklahoma, Texas and Louisiana. Lighter bodies and bonnets and a shorter cross-arm on the handwheel are the major changes. The one-piece seat insert of buna-N molded integrally to steel wear rings and the hard chromed gate plus most of the other parts are interchangeable between the 2000 psi and 3000 psi WP valves.

The "Mudwonder" offers eight big advantages in mudline service according to R. A. Durand, Edward sales manager. It cuts down-time; disassembles and assembles easily; keeps piping hook-ups fixed throughout drilling operation; seals drop-tight; operates easier and quicker; stops sanding; gives longer service; and reduces maintenance costs and labor.

Complete information is available from the company or from most oil field supply stores.

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Sensitized Products Booklet

A new special booklet, featuring the Post Sensitized Products line, has been issued as a practical guide to the selection and purchase of reproduction materials and supplies. It contains a detailed and comprehensive listing of dry-developed print making papers, reproduction cloths and films, semi-moist direct process papers, blue print papers and cloths, sepiatone negative and brown line papers, and contact type, wash-off process reproduction cloth and paper, related developer chemicals, eradicators and miscellaneous supplies. It is available on request from Frederick Post Co., 3650 N. Avondale Ave., Chicago 18, Ill.

Metering Gas Flow

Venturi Tube vs. Orifice Plate for Metering Gas Flow, Bulletin 100-L5 of Builders-Providence, Inc., Division of B-I-F Industries, Inc., Providence, R. I., is available from the company. The bulletin describes the application of venturi tubes to measuring the flow of gas at large volumes or at low pressure and compares the operation with comparable orifice plate installation. The eight-page bulletin also includes orifice and venturi tube computations which form the basis for comparisons for venturi head loss vs. orifice head loss.

All-Electric Tracer Control

An all-electric tracer control system which provides automatic control of one or more machine motions is described in a new bulletin announced as available from the General Electric Co., Schenectady 5, N. Y.

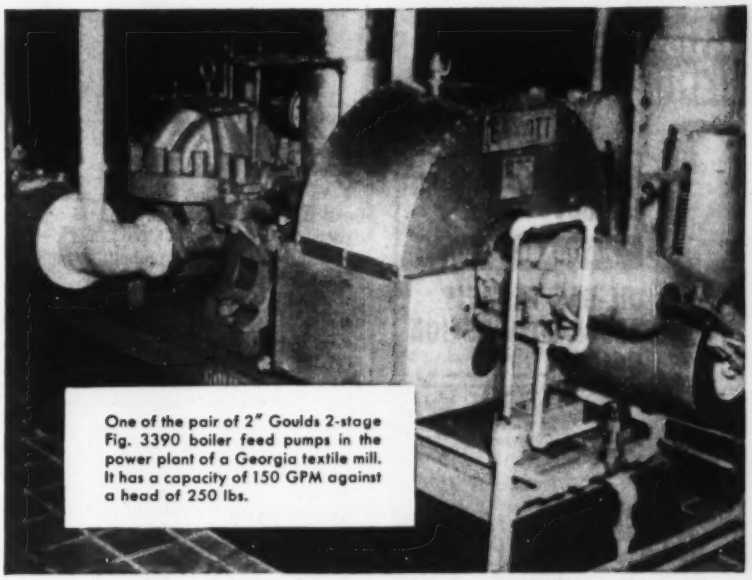
The six-page publication, GEA-6122, explains through the use of diagrams the operation and components of the basic tracer control and its variations. Designed for fast, accurate production on milling machines, vertical boring mills, and lathes, the tracer control automatically follows templates, controlling any number of motions.

Condensed Catalog

Pangborn Corp., Hagerstown, Md., has issued Bulletin No. 1210, a condensed catalog of the entire line of equipment and accessories offered by the firm. The illustrated 24-page bulletin has been provided with a special index which simplifies its use. All equipment and accessories are listed by equipment, by type, and by purpose.

The bulletin discusses rotoblast, airblast and hydraulic methods of abrasive application and pictures and describes the various types of equipment which make use of these three principles. All standard units are described in addition to a limited number of the special machines which Pangborn has developed.

The new bulletin also describes the latest models of rotoblast wheels; the descaling machine for sheets and plates; a self-cleaning dust collector; and the new EV-2 hydrofinish cabinet. Copies may be obtained directly from Pangborn Corp.



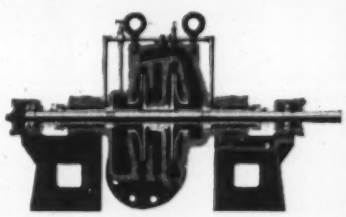
One of the pair of 2" Goulds 2-stage Fig. 3390 boiler feed pumps in the power plant of a Georgia textile mill. It has a capacity of 150 GPM against a head of 250 lbs.

Pair of boiler feed pumps going strong after seven years of round-the-clock service

When an important southern textile mill added a 100,000-lb. steam boiler to one of its power plants in 1947, it installed a pair of Goulds Fig. 3390 centrifugal pumps to feed it.

Since then these pumps have alternated in service at weekly intervals, each pump running continuously 24 hours a day, 7 days a week, when in operation—with only normal maintenance.

That's an example of the kind of performance you can expect from Goulds pumps in any kind of industrial application. Goulds engineers have a background of knowledge and experience gained through 106 years of pump manufacturing. They are ready to help you select the pump that meets your specific requirements, or to consult with you on any pumping problem. Your inquiry will be welcome.



Cross-section of Goulds 2-stage Fig. 3390 pump, showing impellers opposed for hydraulic balance, and other important features of construction. For additional information ask for Bulletin 722.3.

MEMBER

Goulds PUMPS INC. Seneca Falls New York

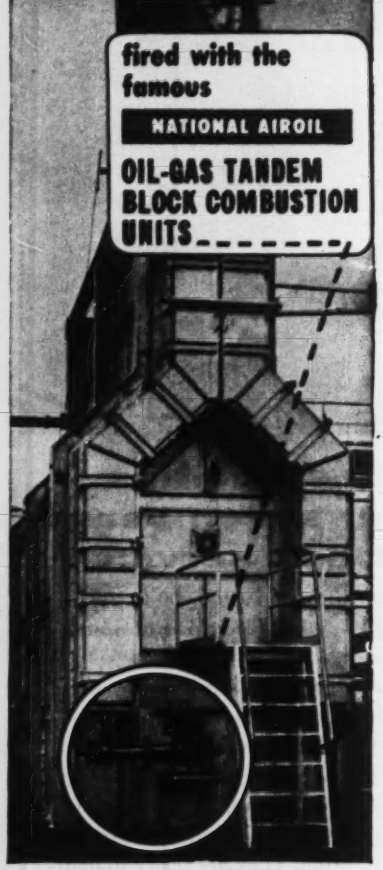
ATLANTA • BOSTON • CHICAGO • HOUSTON • NEW YORK • PHILADELPHIA
PITTSBURGH • TULSA

this new crude oil distillation heater

fired with the famous

NATIONAL AIROIL

OIL-GAS TANDEM BLOCK COMBUSTION UNITS



...MEANS MANY MORE HOURS ON STREAM WITHOUT SHUTDOWN

This heater (RJ Oil & Refining Co., Inc., Princeton, Indiana) is fired from each end with one of NATIONAL AIROIL's #2 combination oil and gas, patented, Tandem Block Combustion Units.

The Tandem Unit is always fired with NATIONAL AIROIL Combination Oil and Gas Burners . . . has a high turndown ratio with a steady flame . . . maintains required temperature using either fuel . . . radiates heat uniformly without tube impingement. With the Tandem Unit's clean flame, a cold furnace can be brought to full capacity in a shorter time.

You will realize more satisfaction from YOUR heaters when NATIONAL AIROIL Tandem Combustion Units are specified.

NATIONAL AIROIL BURNER CO., INC.

1239 East Sedgley Ave., Philadelphia 34, Pa.
Southwestern Division: 2512 So. Blvd., Houston 6, Tex.

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Component Parts Catalog

Announcement has been made of the publication of a new 100-page bound component parts catalog GEC-1025 published by General Electric Co., Trumbull Components Dept., Plainville, Conn. It is designed specifically for original equipment manufacturers who incorporate electrical components into their products for resale. The new catalog contains complete information on circuit breakers, disconnect switches, open knife switches and component parts used in switchboards and panelboards. Interested purchasing, operating, design and electrical engineers will find this new publication a valuable source of information.

More than 2500 catalog numbers are listed including descriptions, list prices and dimensional outline drawings on the majority of products. Copies are available on request from G-E Apparatus Sales District Offices or from Trumbull Components Dept. headquarters.

Silent Chain Drives

An 88-page Silent Chain Book, No. 2425, containing engineering data, has been published by Link-Belt Co., 307 N. Michigan Ave., Chicago 1, Ill. Silent chain is constructed of leaf links having inverted teeth designed so that they engage cut wheels, similar to the way a rack engages a gear. The steel bushings are case-hardened, and the pins are case-hardened and precision ground.

Pre-engineered stock drives for normal requirements are listed in one 16-page section of Book 2425. Another section of 22 pages outlines the procedure for selecting completely engineered drives. It includes a table of service factors, rating tables, and chain length, and center distance computations.

A section on drive components lists available chain widths, chain and wheel dimensions, wheel tolerances, materials, and other pertinent data. The section on accessories covers casings and tensioners. Operational and technical data, such as installation, maintenance, and lubrication procedures, are described in the final section. A copy of Link-Belt Book No. 2425 will be sent to interested readers without charge, on request.

Hydraulic Aireraft Pump

Watertown Div., New York Air Brake Co., Starbuck Ave., Watertown, N. Y., has released a brochure on its 66W series variable delivery hydraulic pumps for 3000 psi operation with rated capacities from 2 to 10 gpm at 1500 rpm; 3750 rpm continuous duty with 4500 rpm intermittent duty. The four-page folder describes the pumps covering pressure regulation, lubrication, priming, hydraulic fluid, installation and maintenance. It also lists a number of specific applications. Large colored cutaway drawings describe working parts of the new pumps and the function of each. Other cutaway drawings show the 66W in operation at full, partial and zero flow.

Ductile Cast Iron

International Nickel Co. Inc., 67 Wall St., New York 5, N. Y., announces Bulletin DI-1, 12 pages with illustrations, graphs and charts, describing a recently developed family of irons which possesses the process advantages of cast iron and which has engineering properties that approach those of cast steel. Strengths up to 120,000 psi, substantial ductility and resistance to heat and wear are reported. Potential applications in numerous fields are indicated.

Centrifugal Wash Collector

The Ducon Co. of Mineola, L. I., N. Y., has announced technical literature, free upon request, giving data on its series of UW-3 Centrifugal Wash Collectors.

These collectors, described as "package" units combining exhauster and precipitator components, have been used to control dust and fumes and to reclaim valuable materials. The company reports that they have handled such difficult dusts as carbon black, limestone, pigments, and glazing particles with efficiencies of over 99 per cent by weight.

The technical brochure on the Ducon UW-3 Wash Collector describes, with text, pictures, and charts, the principles of its two-phase system and illustrates the Collector in various applications. A chart of pertinent data is given on the last page. Bulletin W-7053 may be had by writing to the Ducon Co., 147 E. Second St., Mineola, L. I., N. Y.

Ground Parts Booklet

An eight-page booklet which outlines facilities for producing machined, hardened and ground parts to specification and shows typical parts, equipment available for automatic screw machine operations, turret-lathe work, internal, external and surface grinding, secondary and finishing operations, heat-treating and inspection is available from Special Parts Dept., Orange Roller Bearing Co., Inc., Orange, N. J.

Gage, Valve Bulletin

Jerguson Gage & Valve Co., 80 Fellsway, Somerville, Mass., has issued New Data Unit 238 which shows the variety of connections available with Jerguson gages and valves. A series of drawings illustrates end connected gages, close hook-up side connected and close hook-up back connected gages, and jacketed gage connections.

Cemented Carbide Tools

Latest information on the maintenance of cemented carbide tools for the mining industry is included in a new manual now available from Carboloy Dept. of General Electric Co., Detroit 32, Mich.

The 17-page maintenance manual, CM-121, outlines basic principles of grinding and describes grinding procedures for cutter and finger bits, roof-bolt and auger drills. It also includes pictorial examples of the maintenance recommendations, and grinding techniques.

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Teflon Booklet

A complete description of Teflon tetrafluoroethylene fiber, a new fiber-resistant to heat and chemicals, is presented by the Du Pont Co., Wilmington 98, Del.

Produced only in experimental quantities at present, Teflon fiber is being evaluated strictly as a tool for industry. The company emphasizes that there are no textile apparel uses envisioned for the fiber at this time. Development of a Teflon fiber expands the uses of this material which is now produced by Du Pont in such forms as plastic molding powder, certain finishes, and Teflon impregnated glass fabrics and tapes. It has a high mechanical strength over a wide range of temperatures, and retains useful strength to over 400 F, and for some applications even over 500 F. Its impact strength is high even at −90 F.

Projected end-uses for Teflon fiber include liquid-filtration fabrics, gas-filtration fabrics, packing for pump and valve shafts, gaskets for flanged piping and other joints, laundry textiles for press covers, pads, and roll covers, special conveyors and beltings, special roll covers, diaphragms for valves, electrical tapes and wire wraps, and sewing thread, according to the company.

Electronic Computers

The significant principles and components of electronic data-processing equipment are described in *Light on the Future*, an illustrated booklet now available from International Business Machines Corp.

After a brief comparison of the construction and applications of analog and digital computers, the booklet explains the organization of digital computers and describes briefly the functions of the input, storage, arithmetic, control, and output components.

Many digital computers, including IBM's latest "giant brain," the Type 701 electronic data-processing machines, perform internal operations in the binary number system, although initial data and final results may be in the familiar decimal system. A chart in the booklet compares the decimal numbers from zero to thirteen with the corresponding symbols in the binary and obsolete Roman systems.

Devices for the storage of information, or "memory" devices, (magnetic tapes, magnetic drums, and cathode ray tubes) are described in detail. These devices enable a program, or series of instructions for solving a problem, to be stored along with problem data, making it possible for all operations to be carried out automatically. The booklet discusses the stored-program concept and its advantages.

A brief section discusses future possibilities in the field of electronic equipment, and the booklet concludes with a glossary. A free copy of *Light on the Future* will be sent by the IBM Dept. of Information, 590 Madison Ave., New York 22, N. Y.

Plant Layout Models

"Visual" Plant Layouts, Inc., Pennsylvania Ave. at River, Oakmont (Alleg. Co.), Pa. has announced that its 1954 catalog is ready for release.

The catalog details "Visual" Equipment supplied, together with prices, and explains the new system under which "Visual" Plant Layouts can be purchased. This system operates on a progressive payment basis (minimum total order: $2,500.00), in which the equipment is furnished immediately but billing is in twelve equal parts, with a monthly invoice.

Catalog will be sent, free of charge, on letterhead request.

Water Problems

The highlights of 30 years of the procurement, treatment, use and disposal of industrial water have been condensed into a new ten-page booklet, "What Is Hall Laboratories?" Briefly touching on production problems in steel, textile, chemical and metal plating plants, plus a paper mill and a refinery, the new literature reports on Hall Laboratories tracing the cause of troubles to the industrial water system—between its source and its final effluent. It is available without cost from Hall Laboratories, Inc., Hagan Bldg., Pittsburgh 30, Pa.

Heat Treating Metals, Alloys

A new bulletin on furnaces for heat treating non-ferrous metals and alloys is now available from Surface Combustion Corp., Toledo 1, Ohio. Furnaces for copper and copper alloys, aluminum and magnesium alloys plus others such as titanium, high-nickel and chromium alloys are included. Forming, annealing, solution heat treating and aging are examples of some of the process equipment illustrated and described. The latest developments in equipment for controlled atmosphere processing and the use of high speed or high thermal heating for forming are also described in detail.

Low-Lift Platform Truck

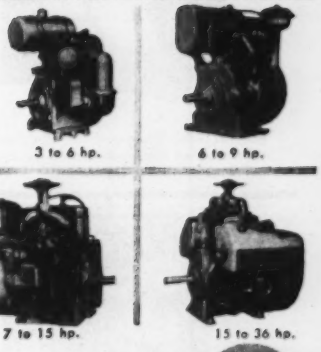
A low-lift platform truck equipped with four-wheel steering to provide maximum ease in negotiating right-angle turns from and into narrow aisles is described in a four-page folder issued by the manufacturer, The Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland, Ohio.

With a load capacity of 4000 lb, the truck, Model EP4-11, is available with both electric or gasoline-electric powered units. It uses a two-wheel drive, and has a maximum length of 125 in., a width of 41¼ in., and turns in intersecting aisles of 69 in. It has a four-in. grade clearance.

Most Specified for ORIGINAL EQUIPMENT POWER

WISCONSIN HEAVY-DUTY Air-Cooled ENGINES

3 TO 36 HORSEPOWER



In the design, manufacture, and ultimate use-purchase of mechanized field and industrial equipment . . . Wisconsin Heavy-Duty Air-Cooled Engines are specified as Original Equipment Power Components to a greater extent than any other make of engine, within a 3 to 36 hp. range.

This dominant preference must necessarily be based on actual *performance records* of users . . . because Wisconsin Engines are not sold on a "price" basis. These engines have the inherent Lugging Power that *stays with the job*, eliminating "stop-and-go" delays, saving manpower and manhours . . . and delivering "Most H. P. Hours" of on-the-job service, with minimum servicing.

If this makes sense to you, let's get together. Write for engineering and descriptive data.

Power TO FIT THE JOB

Power TO FIT THE MACHINE

WISCONSIN MOTOR CORPORATION

World's Largest Builders of Heavy-Duty Air-Cooled Engines

MILWAUKEE 46, WISCONSIN

Model 93: a super fast, virtually automatic machine for engineering departments with unusually heavy copying requirements.

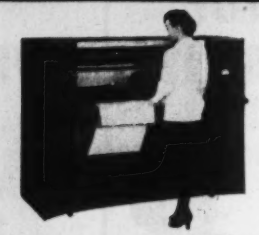
Model 18: A compact, handsomely styled unit for desk-side use. Extra-fast because it operates on 230 volt current.

Model 50: Moderately priced, but produces copies at a rate comparable to the largest machines. Full 46-inch printing width.

Model 14: Another desk-side copying machine, but one which operates on standard 115 volt alternating current.

Choose Your Copying Machine from a complete line!

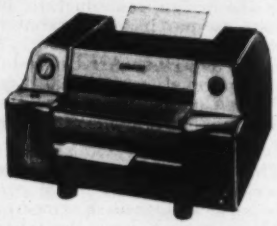
There is a BRUNING Copyflex to Suit Every Need . . . Fit Every Budget!



Model 30: Designed for drafting rooms with medium copying requirements and a modest budget for equipment.

Model 11: Consists of a printer, a developer, and a combination stand—each unit may be purchased separately if desired.

Model 20: A low-cost, standard 46-inch printing width machine which operates on regular 115 volt A. C. electrical circuit.



Model 100: An all-purpose desk-top copying machine with 11-inch printing width. Operates at 12 feet per minute.

BRUNING Copyflex

Copies anything typed, written, printed or drawn on ordinary translucent paper—in seconds.

CHARLES BRUNING COMPANY, INC., 4700 MONTROSE AVE. • CHICAGO 41, ILLINOIS

Weldment Fabrication

Photographs of unusual applications of welded fabrication are featured in a new, two-color brochure, "You're always ahead with Acme Planned Weldment Fabrication," issued by Acme Welding, division of The United Tool & Die Co.

Among the weldments shown are complex rotors, housing, bases, machinery frame members, shells, and pressure vessels—all illustrating particular construction problems and their solution by weldment fabrication. Indicated is the wide range of possibilities for product improvement provided by modern welded design.

Also illustrated and described in the brochure are some of the facilities used by large fabricators to meet unusual fabrication requirements. Copies of the new brochure may be obtained by writing to Acme Welding, 1030 New Britain Ave., West Hartford 10, Conn.

Vacuum Pump Bulletin

The operation and construction of Allis-Chalmers single-stage water-cooled rotary compressors and vacuum pumps is described in a new 12-page bulletin released by the company. The bulletin cites eight reasons why Allis-Chalmers compressors and vacuum pumps provide more air at less cost, gives general specifications for the units along with typical air piping arrangement diagrams and proper accessories designed to get the most satisfactory results. Copies of the bulletin, "Single Stage Rotary Compressors—Vacuum Pumps," 16B8126, are available on request from Allis-Chalmers Mfg. Co., 949 S. 70th St., Milwaukee, Wis.

Air Control System for Excavator-Cranes

A 12-page illustrated brochure describing the air control system on its "Michigan" line of excavator-cranes is now available from Clark Equipment Co.'s Construction Machinery Div., Benton Harbor, Mich.

The brochure, illustrated with pictures and drawings, explains the theory and practical application of the air-controlled clutches which are standard equipment on all "Michigan" excavator-cranes. A series of cross-sectional sequence drawings illustrate the operation of the air control valve used in the air-control system.

Graphed and tabular data is presented which give comparative figures on time tests between machines equipped with air controls and mechanical controls. Eight case history "shorts" included in the brochure report the operating experience of owners and operators with their air-controlled "Michigan" excavator-cranes on construction, scrap handling, steel erection, and other projects.

The brochure may be obtained by writing to Clark Equipment Co., Construction Machinery Div., Benton Harbor, Mich.

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NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Continuous Blowoff Equipment

A bulletin, No. 2391A, has been prepared by The Permutit Co. describing how automatic continuous blowoff equipment successfully meets the demands of modern boilers. Furnished in four typical arrangements, the equipment provides economy of fuel, smaller quantity of blowoff, elimination of foaming and priming, reduction of make-up requirements, continuous blowoff and less strain on boiler metal.

Typical arrangements are illustrated together with cost-saving examples. Also pictured are illustrations of the equipment and accessories. The bulletin is available from the company at 330 W. 42nd St., New York 36, N. Y.

Hydraulic Equipment

A new 12-page, two-color, illustrated catalog, 54-66, describing Vickers oil hydraulic power and control equipment for the textile industry is now available from Vickers, Inc., 1400 Oakman Blvd., Detroit 32, Mich. Cost-saving and operating advantages of typical textile machinery oil hydraulic variable speed drive and power unit applications on pads, entcering frames, dye becks, are described and illustrated in the catalog.

Specifications, performance curves and operating descriptions are given for a range of six standard models of integral hydraulic transmissions and controls rated from ¾ to 25 hp. Specification tables are included for 24 standard models of variable delivery and variable displacement piston-type hydraulic pumps and motors. Standard and custom-built hydraulic power units and single and two-stage vane-type hydraulic pumps are described.

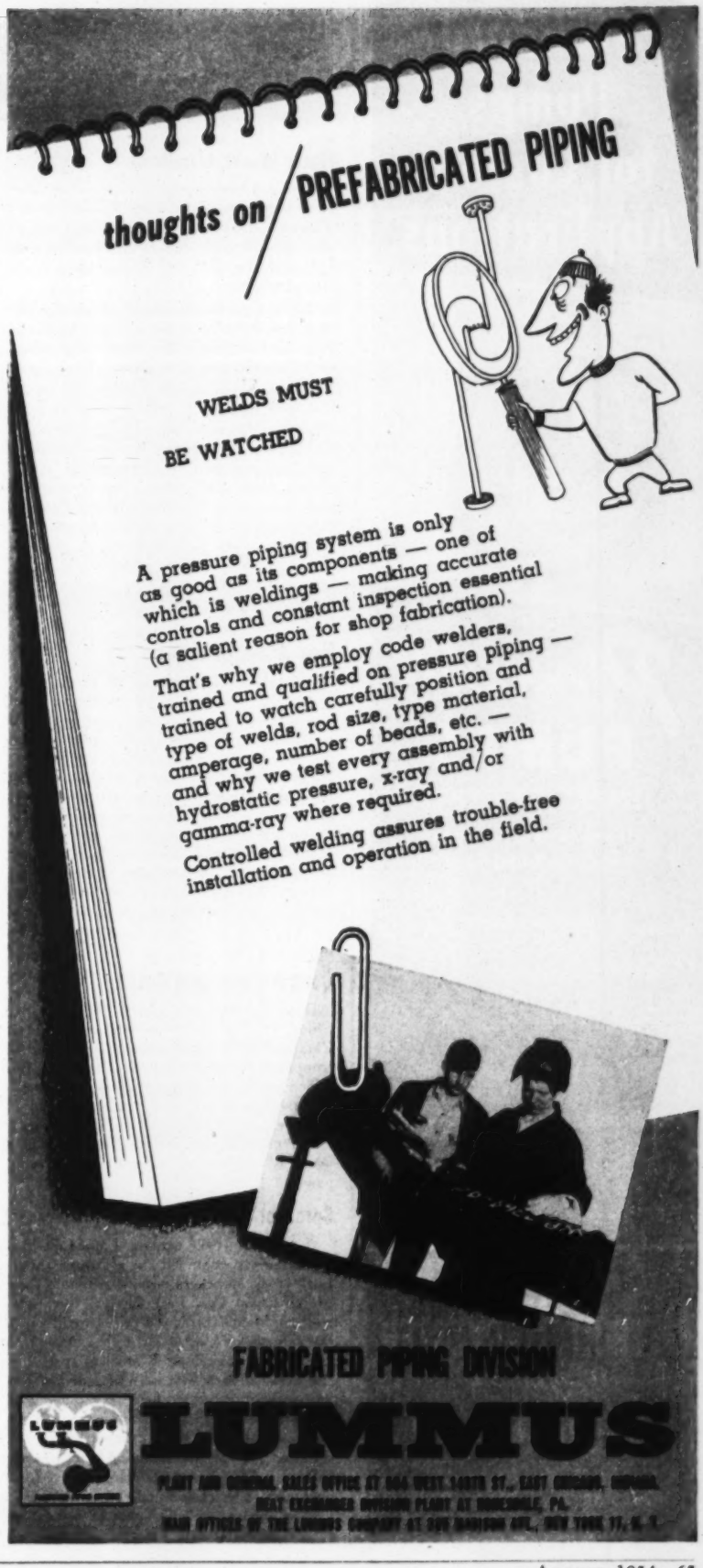
Pump Fundamentals Booklet

Ingersoll-Rand, 11 Broadway, New York 4, N. Y. has available a 12-page booklet on "Centrifugal Pump Fundamentals," Form 7287, for pump operators and installation and maintenance men. The booklet defines the various terms used in pump calculations and works out typical pump problems.

Heating Panels

A 12-company report on the use of Platecoils in a variety of process heating and cooling applications has been published in a 20-page brochure by Tranter Mfg., Inc., Lansing, Mich. This bulletin contains factual reports on the experiences of companies with 12 different processing operations. Firms reported on in their use of Platecoils include Addressograph-Multigraph Corp., Continental Motors Corp., Burroughs Corp., Sealed Power Corp., Old Colony Tar Co., and Lycoming Spencer Div. of Avco Corp. Reports range from alkaline stripping and flexseal coating to tar transfer and quench oil cooling.

Copies of the brochure No. 154 may be obtained from Tranter Mfg., Inc., 736 E. Hazel St., Lansing 4, Mich.


thoughts on PREFABRICATED PIPING
WELDS MUST
BE WATCHED
A pressure piping system is only as good as its components — one of which is weldings — making accurate controls and constant inspection essential (a salient reason for shop fabrication).
That's why we employ code welders, trained and qualified on pressure piping — trained to watch carefully position and type of welds, rod size, type material, amperage, number of beads, etc. — and why we test every assembly with hydrostatic pressure, x-ray and/or gamma-ray where required.
Controlled welding assures trouble-free installation and operation in the field.
FABRICATED PIPING DIVISION
LUMMUS

Standard Pumps for Custom Applications

Pioneer PUMPS

IMPELLER TYPES

from 0 to 174 gpm
850 to 3450 rpm

Types available:

Seal and Seal-less
Integral Motor Mounted
Belt and Motor Base
External or Submerged
IIC Standard
Self-Priming Auxiliary Units

Ask for Complete Catalog of Pumps and Accessories

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Water Works Handbook

A revised twelfth edition of its pocket-size water works handbook with 28 added pages of water meter change gear charts and several other new features has been issued by the Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh, Pa.

Cutaway drawings of eight principal types of meters have been included in the handbook, and various other charts and tables have been brought up to date.

In addition to specifications tables for all Rockwell meters, the book includes such general information as standard specifications for cast iron and standard wrought iron pipe, table of equation of pipes, water meter testing hints and tables, instructions for reading water meters, water use rate tables, flow charts, and hose and fire stream data. It also includes basic information, such as the properties of water, weights and measures, and conversion tables. Copies of the handbook are available at all Rockwell district offices.

New Alloys Bulletin

"Nickel-Aluminum Bronze," Bulletin A-133, 12 pages, with tables of properties and illustrations of applications, has been announced as available from International Nickel Co., Inc., 67 Wall St., New York 5, N. Y. It describes a group of zinc free, tin free, high strength copper-base alloys that possess high resistance to corrosion, erosion, cavitation and wear, and that may be heat treated like steel to increase their strength and hardness. Their toughness, weldability, workability and low specific gravity are discussed. Applications are presented for the marine, aircraft, chemical, electrical and other industries.

Control Equipment Catalog

O. C. Keckley Co., 400 W. Madison St., Chicago 6, Ill., announces the publication of Catalog No. 54 on steam and liquid control equipment. Tabular material has been simplified and quick reference tables on pressures and temperatures, water heads and equivalent pressures, flange data and pressure regulator capacity are included in the catalog which is available on request from the company.

Sprocket Catalog

A new eight-page catalog, C56-54 describing the newly expanded line of Morse Taper-Lock stock sprockets is now available from Morse Chain Co., 7601 Central Ave., Detroit 10, Mich. Sizes and prices are given in the catalog for 1/2, 5/8, 3/4, 1, 1 1/4, 1 1/2, 1 3/4, and 2-in. pitch Type B stock Taper-Lock sprockets with a hub on one side. Prices and sizes are also listed for 1 1/2, 1 3/4 and 2-in. pitch Type C stock Taper-Lock sprockets with a hub on both sides. Taper-Lock stock bushings are also specified and priced in the catalog. Tables listing prices for Morse packaged roller chains and roller chain links are included as well as Taper-Lock bushing installation and removal instructions.

Offers Monthly Sketchbook

G. H. Leland, Inc., Dayton 2, Ohio, has announced it will distribute, approximately once a month a two-page engineering "Sketchbook" designed to present Ledex products information, and interesting applications with schematic diagrams.

Industrial Filters

A new catalog describing its full line of industrial Auto-Klean filters has been published by The Cuno Engineering Corp., Meriden, Conn. Principles, construction and advantages are described in full. Specifications and capacities are given for all standard models having flow rates between 1 and 3760 gpm, and normal operating pressures of 125 psi. Applications and case studies indicate the wide range of service for Auto-Klean filters. Conditions requiring other types of filters are also included together with a complete listing of all Cuno offices. Catalog number is AK-050.

Chemical-Resistant Gaskets

The United States Gasket Co., Camden 1, N. J., has announced a catalog on Chemiseal Gaskets and accessories for chemical-resistant piping and equipment. These gaskets are claimed to be impervious to all chemicals except molten alkali metals, fluorine at elevated temperatures, and chlorine trifluoride.

Illustrated and described are ten types of Teflon-Jacketed Gaskets, Molded Teflon Snap-on Gaskets for conical end glass pipe, Teflon Jacketed Adaptors for connecting unlike nozzles, Teflon expansion joints and Flexible Couplings, and solid Teflon ring gaskets and special shapes.

Bulletin No. TG-953 will be sent on request.

Refractories Bulletin

Two Harbison-Walker refractories, Coleman XX for high duty service and Coleman for intermediate duty service, are detailed in a new eight-page bulletin available from Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh 22, Pa. In addition to descriptive details, the bulletin includes charts showing spalling resistance, the results of load tests, and thermal expansion. A section also is devoted to several other products stocked at Harbison-Walker's Athens plant.

Gage and Valve Catalog

A new catalog, No. 236, which covers practically the complete Jerguson line of liquid level gages and valves with a condensed presentation of the most pertinent data and specifications, has been released by Jerguson Gage and Valve Co., 80 Fellsway, Somerville 45, Mass. Included are illustrations of the various standard and special function Jerguson gages and valves, description of features and uses, materials used, steam ratings of gages, dimensional drawings, and a full-page table giving standard and optional construction features and specifications.

Coordination Control

A file of application engineering data on the new two-lever coordination control by Pantex Mfg. Corp., has been published and is available.

Eight pages of material describe alternate methods of arranging the latch and release mechanism so that different types of coordination between the two levers will actuate the unit: when both levers are operated simultaneously; when the levers are operated in a given sequence; when the levers are operated in arbitrary sequence; when the levers are operated either simultaneously or in arbitrary sequence.

One section is devoted to analyzing uses for various electrical, pneumatical and mechanical actuation systems. The study also shows how dual units may be connected in series or parallel for safety and remote control purposes. Prices, specifications, capacities, operating forces and mounting data are given in the bulletin, No. 68123 from Pantex Mfg. Corp., P. O. Box 660, Pawtucket, R.I.

Steel Heat Treating

A new booklet on "Electreat," heat treated cold finished steel, has just been released by Jones & Laughlin Steel Corp., 3 Gateway Center, Pittsburgh 30, Pa. The booklet describes with pictures the J&L method of heat treating cold finished steel bars, utilizing an electric induction heating and quenching machine. Listed in the booklet are advantages of the method, and exclusive features of Electreat.

Impact Machines

Sonntag Impact Machines with maximum capacities of 240 ft-lb and 48 ft-lb for metals and plastics respectively are described by Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa., in a four-page bulletin, No. 4211. Design features of these pendulum-type machines are illustrated and specifications tabulated.

Copies are available on request.

Velocity Stage Turbines

A four-page illustrated bulletin, No. 4202, describing De Laval velocity stage class CA turbines has been issued by the De Laval Steam Turbine Co., Trenton 2, N. J. The CA turbine for mechanical drive operates under all inlet steam conditions up to 600 psig and 750 F. Modified construction allows maximum inlet temperature of 825 F.

Maximum speed of the CA turbine, which is available in two frame sizes, is 4000 rpm with the shaft governor. Speeds are increased up to 6000 rpm with vertical or hydraulic governors. Design features, which are shown on a large cut-away drawing, include centerline support and flexible front end mounting for radial and axial expansion. These features assure alignment with the driven machine over the entire operating temperature range.

O Rings

A 16-page brochure documenting in detail the production and application of rubber O-ring seals has been published by Minnesota Rubber & Gasket Co., Minneapolis, Minn.

Included in the brochure are sections on end products, O-ring sizes, dash numbers and variable tolerances, dimensional data for installation of standard size O-rings, cross-sectional drawings of correct and incorrect installations, and methods of utilizing O-ring sealing properties. Requests should be directed to Dept. KP, Minnesota Rubber & Gasket Co., 3630 Wooddale Ave., Minneapolis 16, Minn.

Cooling Tower Catalog

Halstead & Mitchell, Bessemer Bldg., Pittsburgh, Pa. offers a new commercial cooling tower catalog, containing new material on air-conditioning cooling tower applications, specifications, selection and installation. The 16-page catalog, WT & CT-583, describes the operating characteristics of 20 standard Halstead & Mitchell commercial cooling towers, ranging in capacity from 5 through 60 tons. Several pages are devoted to tables, drawings and graphs. Information includes a comprehensive table of cooling tower nominal ratings for both 78- and 75-deg wet bulb temperatures, outlet water temperature plotted against wet bulb temperature, tower capacity plotted against wet bulb temperature, layouts for year-round operation and inside use, and much additional data. The catalog describes the basis of Halstead & Mitchell's exclusive 20-year guarantee on the wetted deck surface against attack by rotting or fungus growth, and also discusses the vinsynite, vinyl zinc and chlorinated rubber coatings which are applied to the tower cabinet for protection against corrosion. Cutaway views and line drawings detail mechanical features of the cooling tower construction.

New Switch Catalog

A new catalog, No. 101, entitled "Switches for Industry" has been announced by Micro-switch, Freeport, Ill., a division of Minneapolis-Honeywell Regulator Co. The 20-page catalog covers 22 families of switches, describing 258 different switches, actuators and enclosures. Dimensionalized photos, complete characteristics, electrical ratings and technical data are included.

Bulletin Describes Facilities

Hardinge Mfg. Co., 240 Arch St., York, Pa., has published a four-page folder, Bulletin AS-456, describing its plant facilities and emphasizing the advantages of a medium-size manufacturing firm for "farmed-out" work. The literature is illustrated with photos of the various large and small fabricating tools and typical products of the Hardinge machine shops, plate shop, Meehanite foundry and pattern shop. It illustrates custom built machinery, a specialty of the company.

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Two-Stage Centrifugal Pumps

Worthington Corp. offers a new bulletin on type UNB two-stage centrifugal pumps designed for working pressures up to 400 psi and capacities up to 1300 gpm. Available in bronze, iron, and stainless steel fittings with cast iron, bronze, steel, and stainless steel casings, Worthington says the UNB pump is adaptable to boiler feed, refinery, mine, and other services where moderate heads and high capacities are involved.

The single-sheet bulletin is illustrated by a section drawing pointing out such design features as oil-lubricated ball bearings, Worthington elastic seal rings, and water-cooled, water-sealed stuffing box. The bulletin includes dimension charts and a table giving materials of construction.

Further information or copies of the bulletin will be sent by Advertising & Sales Promotion Dept., Worthington Corp., Harrison, N. J. Requests should specify Bulletin W-318-S27.

New Control Selection Guide

The latest selection information on motor starters and push-buttons is contained in a new publication announced as available from the General Electric Co., Schenectady 5, N. Y. Write for Bulletin GEA-6061.

Vibration Phenomena

A 16-page brochure entitled "Balance-Final Dimension of Precision," is offered upon request by International Research and Development Corp., 168 E. Hosack St., Columbus 7, Ohio. The brochure discusses the relationship between vibration phenomena and precision manufacturing and illustrates the advantages of IRD vibration analysis equipment in seeking out and eliminating unwanted vibration wherever it occurs in rotating parts. Detailed description of the basic model vibration analyzer, and brief descriptions of other equipment in the IRD line are included in the brochure.

HR-6 Cast Alloy

A four-page bulletin has been issued by Standard Alloy Co., Inc., to provide complete engineering reference data on the popular HR-6 (25-12) cast alloy. The bulletin is directed to engineers and designers of equipment parts subject to temperatures up to 2000 F. Chemical, physical, and mechanical properties are tabulated for quick reference. Also, data on design stresses, heat treatment, machinability and weldability are given, making specification of this highly serviceable and economical metal quite easy. Requests are to be directed to the company at 1679 Collamer Rd., Cleveland 10, Ohio.

Thin Bearing Catalog

Publication of a catalog No. 54, describing very thin section bearings has been announced by The Kaydon Engineering Corp., Muskegon, Mich. Titled Reali-Slim bearings, the attractive catalog includes descriptions of bearings with 1/4 in. cross sections and 1/4 in. width up to 12 in. ID, and other listings up to 1 in. cross section width up to 40 in. ID. These are said to be the thinnest bearings ever made in these diameters.

A section of the catalog is devoted to bearings with thin flanges for mounting directly to adjoining structures. Many of these bearings also have gear teeth as an integral part of the race. The catalog is prepared specifically for the aircraft industry and suppliers to that industry, where minimum bearing weight is required.

Magnetostriction Report

"Magnetostriction," Bulletin A-169, is a 28-page, 11-graph booklet with an extensive selected bibliography, announced as available from International Nickel Co., Inc., 67 Wall St., New York 5, N. Y. The report discusses ferromagnetic metals and alloys, giving data on some of their magnetostrictive properties. Numerous devices employing this phenomenon are described and explained.

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MECHANICAL CATALOG

Published annually as a service to members by

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

29 West 39th Street, New York 18, N. Y.

Synthetic Mica Cited

The synthetic mica manufactured by the Mycalex Corp. of America was mentioned by Major Alexander P. de Seversky as an example of the steps necessary to make the United States independent of foreign raw materials, in the symposium "Electronics in Air Power," sponsored by Mycalex in May, 1954.

Major de Seversky believes that such independence is required to prevent weakening of military strength by the loss of vital materials from foreign countries.

A film on "Arcing Test on Plastics," prepared by Boeing Aircraft Co., and excerpts from "Victory Through Air Power," prepared by Major de Seversky and Walt Disney, were shown. A question and answer period closed the symposium.

Mycalex Corp. of America is located on Clifton Blvd., Clifton, N. J.

Coated Abrasives

A new booklet describing the use of coated abrasives for grinding and finishing nonferrous metals is available from Minnesota Mining & Mfg. Co., St. Paul 6, Minn. The booklet, called "Grinding and Finishing Nonferrous Metals With 3M Abrasives," shows before-and-after pictures of aluminum, brass, bronze, manganese bronze and magnesium products on which coated abrasive belts or disks were used. It also illustrates and describes specific grinding operations in nonferrous foundries throughout the country, and shows the use of coated abrasives in the finishing of patterns, molds and dies and the use of pressure sensitive tapes in nonferrous foundries. Diagrams of floor and bench backstands, the platen sander and the portable disk grinder are also included.

Voltage Regulator Practice

The Westinghouse Electric Corp. has made available a 20-page booklet on modern regulator practice. Fundamental application factors of step and induction voltage regulators are discussed, and charts are used to show graphically what popular practice is today. Both types of regulator are compared from the standpoints of maintenance characteristics and the speed of response factor.

Full lines of station and pole-type regulators, both step and induction design, are described. A copy of Booklet B-6053 will be sent on request to Westinghouse Electric Corp., P.O. Box 2099, Pittsburgh 30, Pa.

Automatic Pump Sequence Control Systems

An improved automatic system for varying the number of pumps needed to satisfy fluctuating demands in multiple-pump installations is described and illustrated in Fischer & Porter Catalog No. 91-106, four pages. The principle of kinetic manometry, or direct measurement of a constant percentage of mainline flow through an orifice and taps, is used to actuate a float with an armature attached. Changes in mainline flow move the float up or down, causing armature movement through the electromagnetic field of one or more inductance coils. This inductance change is transposed electronically to an electric signal that either stops or starts, depending on direction of change, the pump corresponding to the coil through which the armature has moved.

Catalog No. 91-106 is available on request from Fischer & Porter Co., 48 Jacksonville Rd., Hatboro, Pa.

Erratum

In the July, 1954 issue of MECHANICAL ENGINEERING, page 70, the item on Norton Co.'s refractories manual contains a misspelling of "Crystolon."

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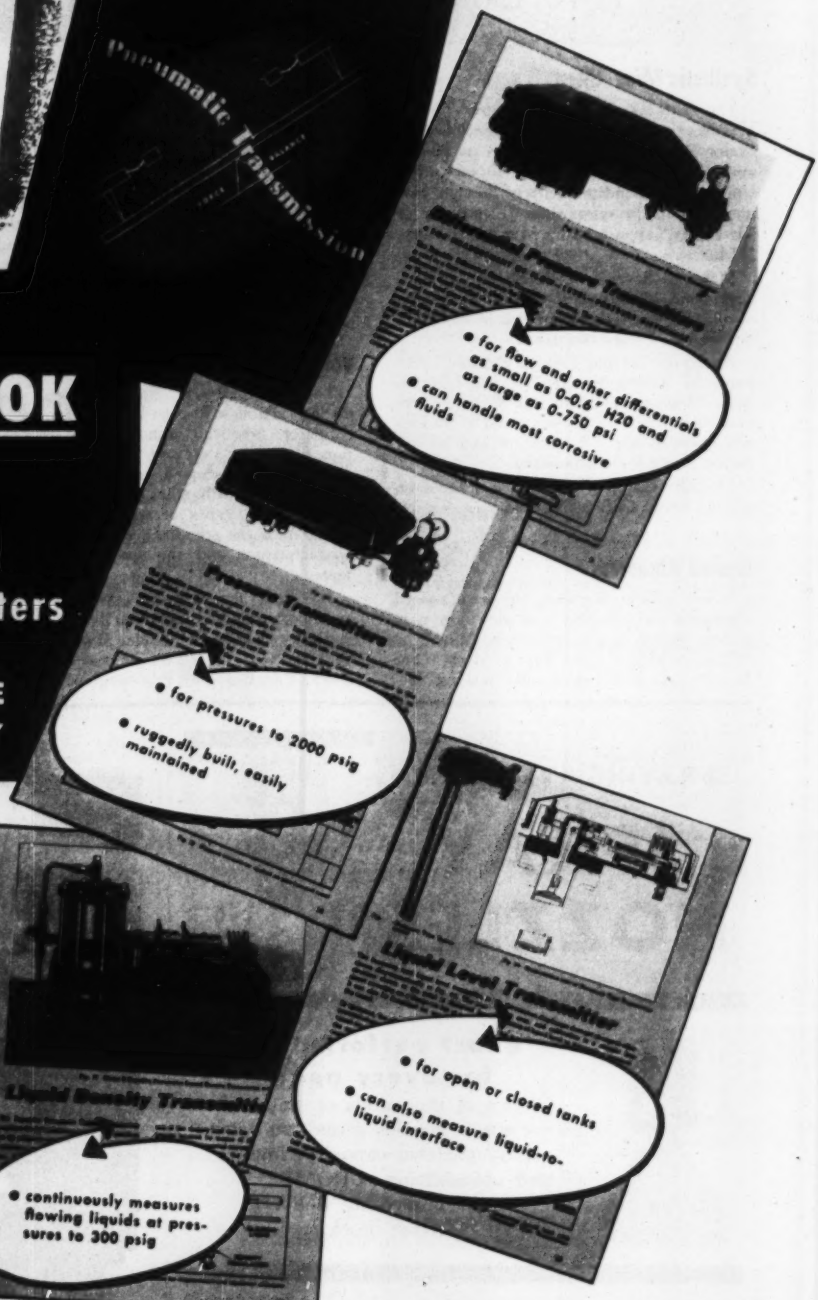
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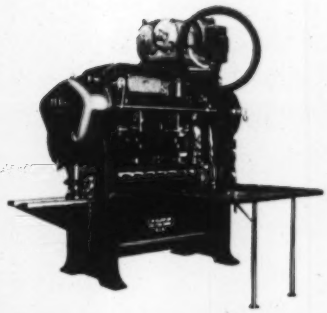
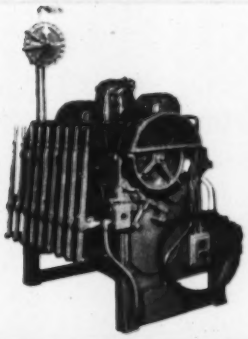
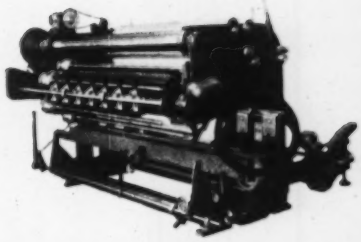






ACROSS-THE-LINE STARTERS FOR ALL TYPES OF MACHINES

A Uniform Line up to 300 HP, 220V; 600 HP, 440-550V

It is a distinct advantage to both buyer and user of motorized machines if the across-the-line starters have a family resemblance over the entire range up to 300 hp, 220 v; 600 hp, 440-550 v. For example, Allen-Bradley solenoid starters are so nearly alike over this range that to be familiar with the structure and operation of a 5 hp starter provides equal familiarity with an Allen-Bradley 500 hp starter. This advantage is limited only to the Allen-Bradley line.

Bulletin 709 solenoid starters are available in dust-tight, waterproof, explosion-proof, and corrosion-proof enclosures.

The Allen-Bradley Handy Catalog is a handbook of control information. Send for a copy.

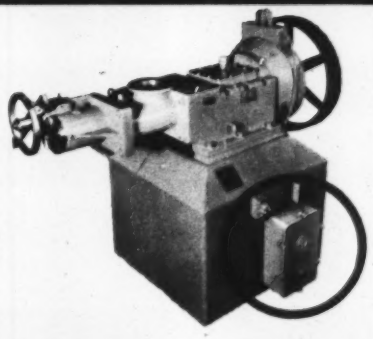
Sizes 0 to 5

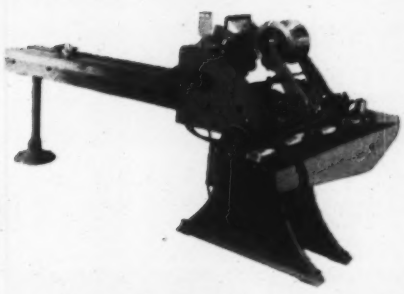
A-B Quality

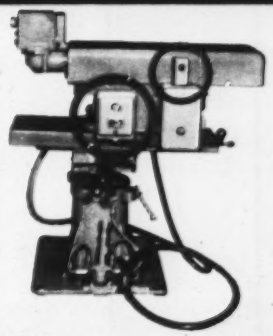
ALLEN-BRADLEY

QUALITY

Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis



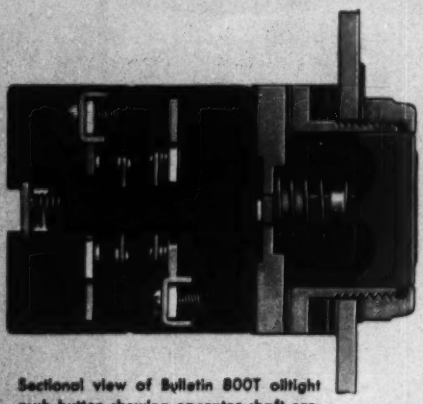




7-54-MR

OILTIGHT PUSH BUTTONS

Start Button with Double Pole NC and NO Contacts

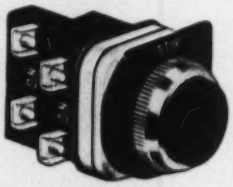


Sectional view of Bulletin 800T oiltight push button showing operator shaft carrying moving contacts. Stationary contacts are mounted in the molded contact block. The oiltight flexible diaphragm is between push button and contact block.

Here are a few of the many Allen-Bradley oiltight pilot units for machine tool service. They are available for mounting on machine frames in a variety of single units or in any combination of one or more units in oiltight enclosures. A flexible diaphragm, not affected by oil or cutting fluids, is inserted between button and contact block (see diagram at left) to prevent oil seepage into the contacts.

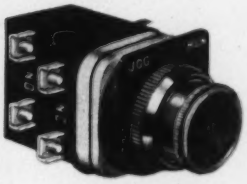
The silver alloy contacts are maintenance free. For complete information on the Bulletin 800T line, send for the new Allen-Bradley Handy Catalog.

Allen-Bradley Co.
1316 S. Second St.
Milwaukee 4, Wis.



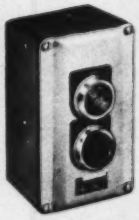
Type BA Stop Button

Type H2B Selector Switch

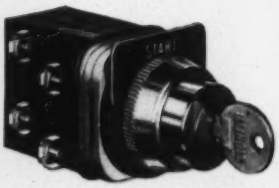


Type K2B Jog Button

Type 6PX Pendent Control



Bulletin 800T Type 2TA in Two-button Oiltight Enclosure



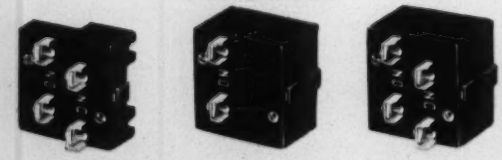
Type E11B Cylinder Lock Button

Type P26 Pilot Light

Assemble any combination of operators and contact blocks

OPERATORS

CONTACT BLOCKS



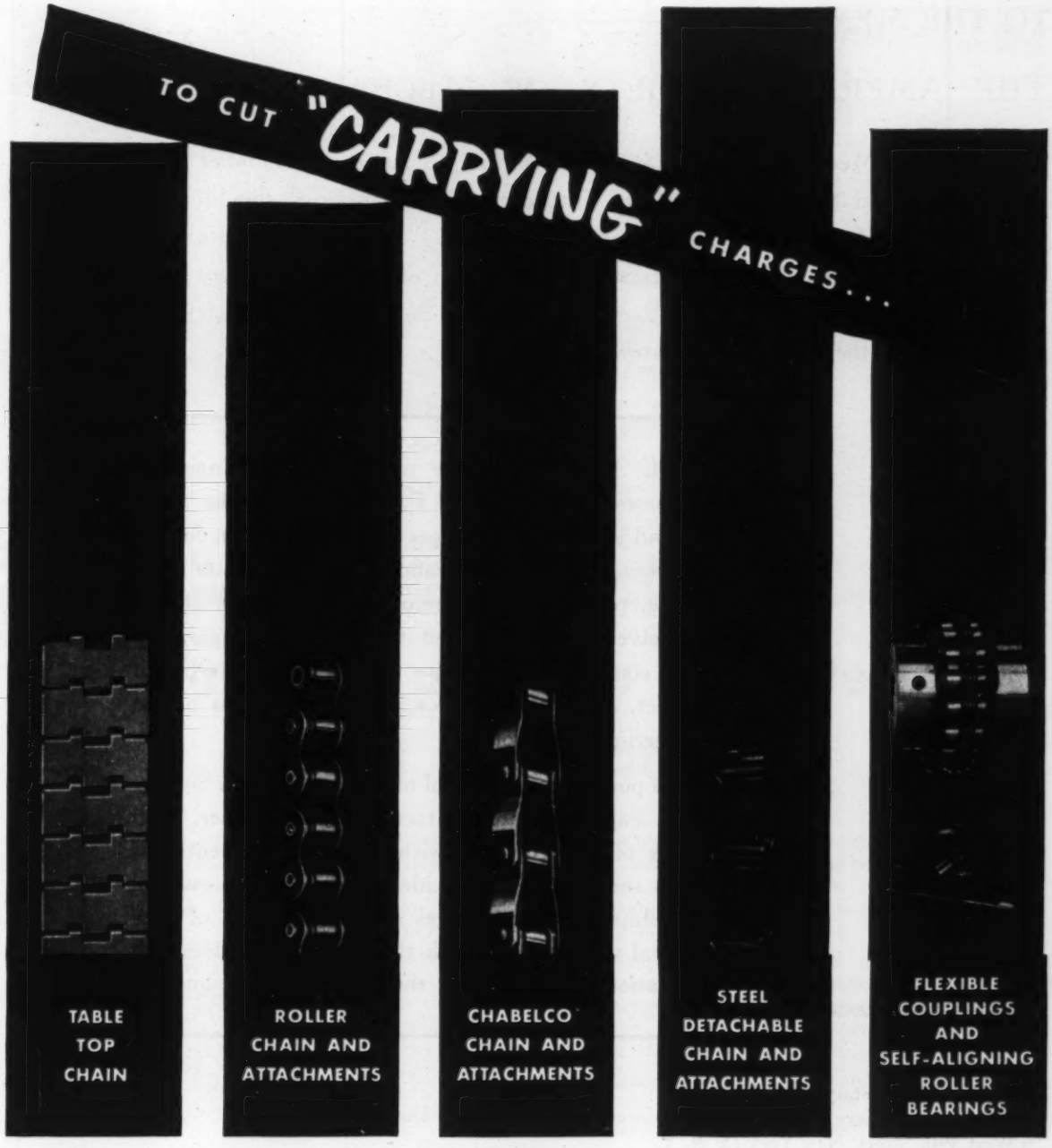
Bulletin 800T operators and contact blocks are available in many forms. They may be assembled interchangeably in various combinations, thus reducing your motor control parts inventory.

A-B

QUALITY

MOTOR CONTROL

TO CUT "CARRYING" CHARGES...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THE American Society of Mechanical Engineers promotes Mechanical Engineering and the allied arts and sciences, encourages original research, fosters engineering education, advances the standards of engineering, promotes the intercourse of engineers among themselves and with allied technologists; separately and in cooperation with other engineering and technical societies, and works to broaden the usefulness of the engineering profession.

As a post graduate school of engineering, the Society brings engineers into contact with each other, with leaders of thought and with new developments; it fosters the interchange of ideas, develops professional fellowships, and encourages a high standard of professional conduct—all with the purpose of advancing civilization and increasing the well-being of mankind.

C. E. Davies, Secretary
The American Society of Mechanical Engineers
29 West 39th Street, New York 18, N. Y.

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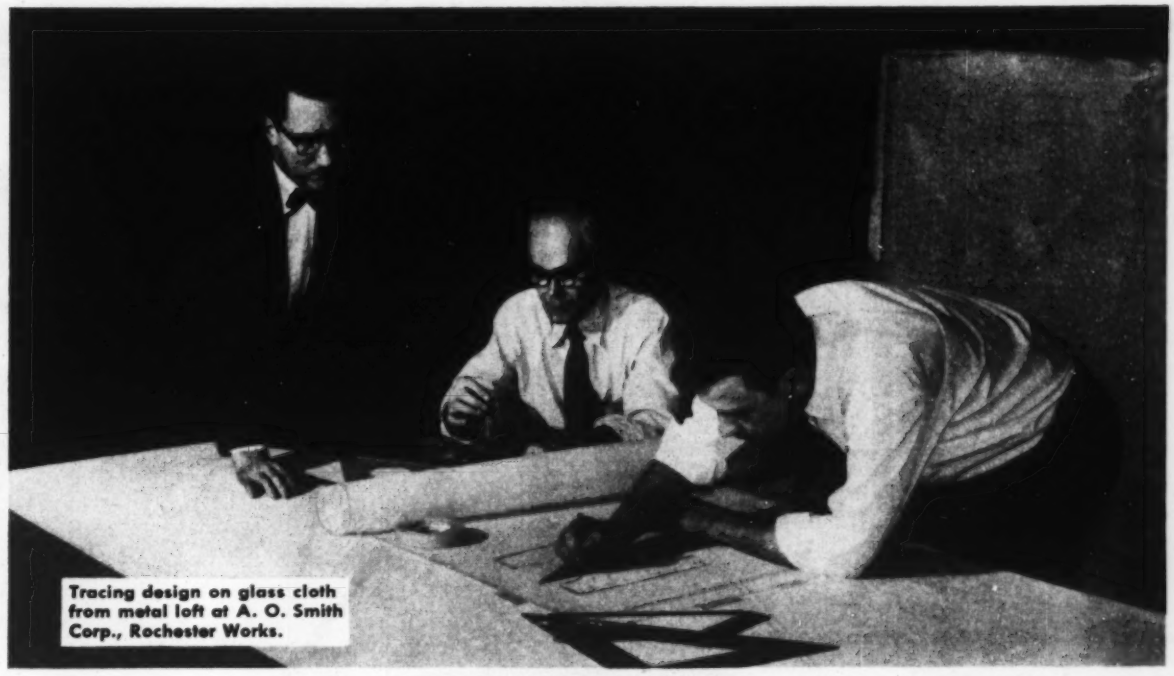

Tracing design on glass cloth from metal loft at A. O. Smith Corp., Rochester Works.

Valuable originals protected against wear and tear

At the A. O. Smith Corp.'s Rochester (N.Y.) Works, large drawings are made exactly to scale on glass cloth. Since these drawings often cost several hundred dollars each, A. O. Smith naturally does not wish to expose them to possible damage during print-making and to the wear and tear of excessive handling. Instead, they use intermediates made on Kodagraph Autopositive Paper.

Costing but a few cents a square foot, Autopositive produces positive photographic prints directly from the original drawings — without a negative step or darkroom handling. It can be exposed in standard print-making equipment and processed in standard photographic solutions. (A. O. Smith uses a vacuum-frame printer, which accommodates drawings up to 8 x 4 feet in size.)

No worries with Autopositive intermediates — they turn out sharp, legible shop prints time after time. Their dense photographic black lines do not smudge or smear. And they can be run at uniform, practical speeds in the company's direct-process machine.

In addition, A. O. Smith keeps an "Autopositive File" showing the history of changes in all their drawings. Before each revision, an Autopositive intermediate is made. Later on, direct-process prints showing the complete story of each design can be made from the intermediates as needed.

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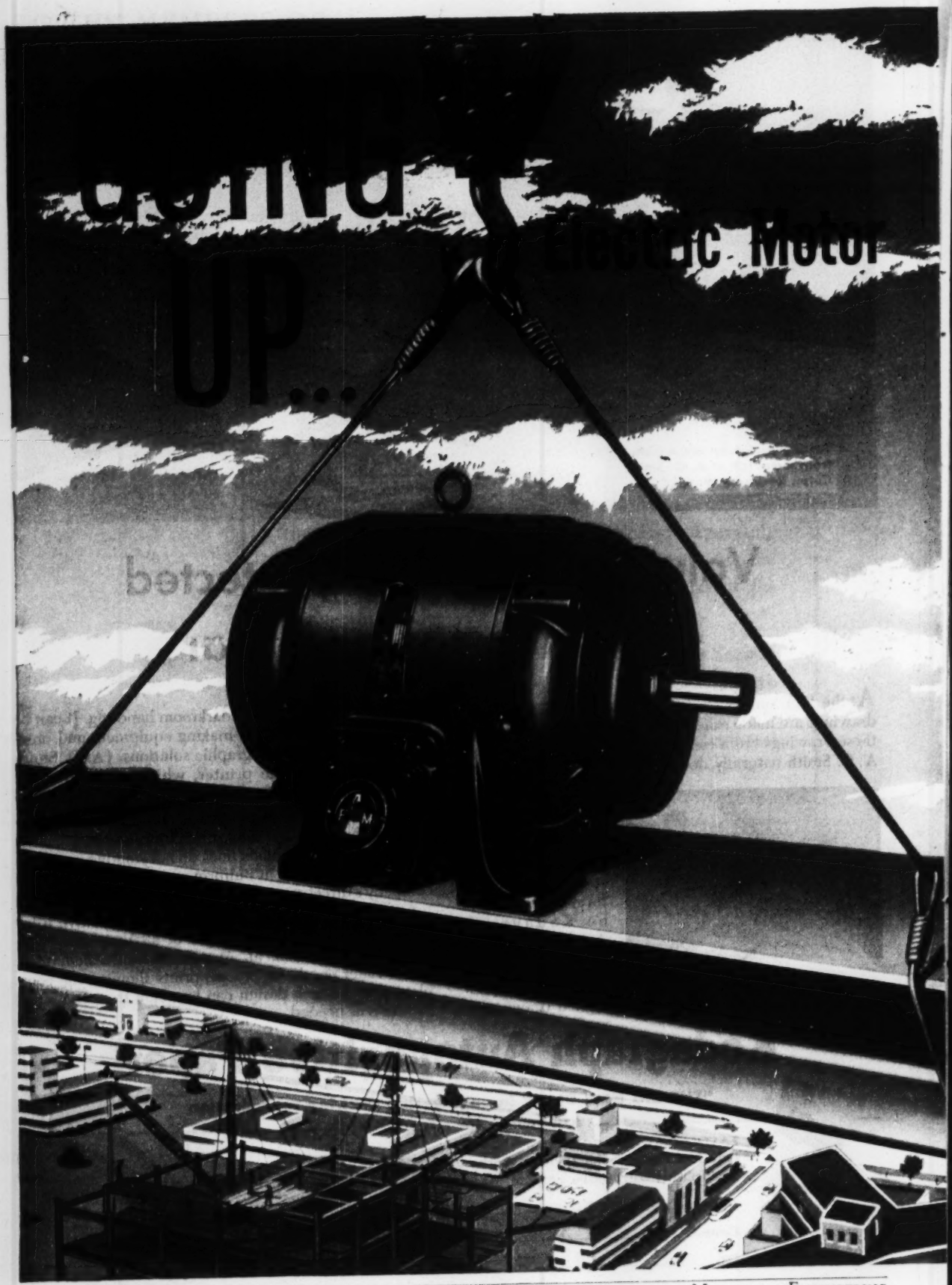
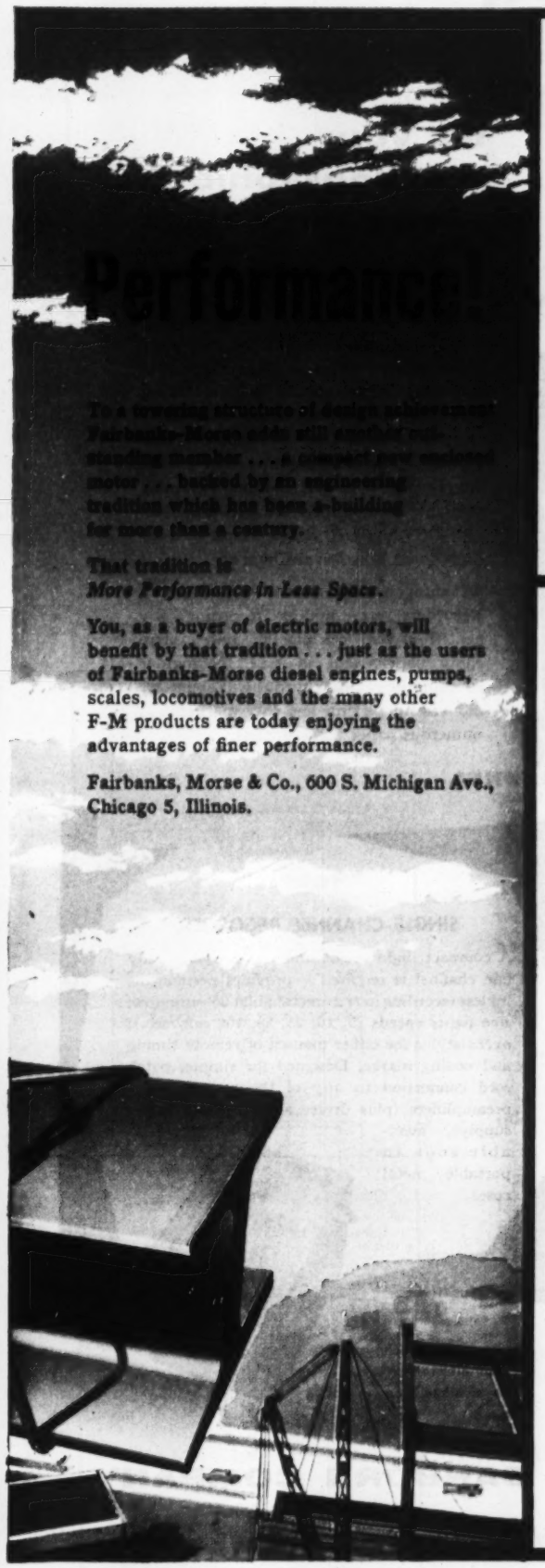

UP...



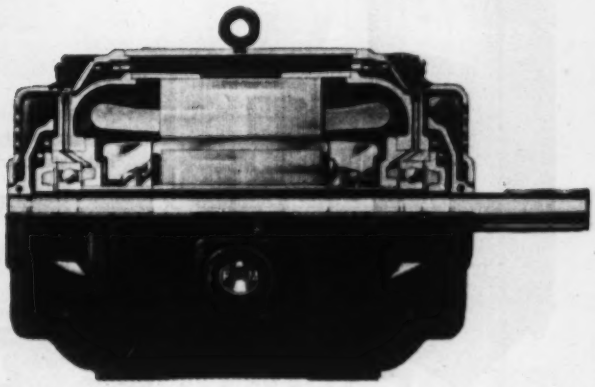
To a towering structure of design achievement Fairbanks-Morse adds still another mid-standing member . . . a compact type enclosed motor . . . backed by an engineering tradition which has been a-building for more than a century.

That tradition is
More Performance in Less Space.

You, as a buyer of electric motors, will benefit by that tradition . . . just as the users of Fairbanks-Morse diesel engines, pumps, scales, locomotives and the many other F-M products are today enjoying the advantages of finer performance.

Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Illinois.

NEW FAIRBANKS-MORSE
TOTALLY ENCLOSED FAN-COOLED MOTORS



TOTALLY ENCLOSED—Wherever adverse operating conditions are encountered, F-M totally enclosed construction effectively insures electrical parts and bearings against contamination by dirt, abrasive dusts, metal particles, corrosive gases and steam.

DOUBLE-END VENTILATION—Cooling air is drawn through guarded openings in both fan shields and uniformly circulated through cored passages surrounding the sealed inner shell. Efficient heat-transfer action insures uniform internal cooling. Exhaust air is discharged through bottom of frame—not across motor and driven machine.

COPPERSPUN ROTOR—Exclusive Fairbanks-Morse feature—an indestructible one-piece rotor—homogeneous, free from flaws for maximum strength and lifetime service.

CONDUIT BOX—New, gasketed, cast iron conduit box permits easy pulling of cables without insulation damage. Fairbanks-Morse exclusive: recess feature allows elimination of conduit box where space is limited.

BEARINGS—Precision ball bearings are effectively sealed against grease leakage and contain ample lubrication for extended periods of rugged service. Convenient means are provided for flushing and relubricating if desired. Cartridge bearing construction is standard on all larger ratings.

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a name worth remembering when you want the best

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WHICH "150" fits your oscillographic recording need?

4-CHANNEL

As a graphic example of the design idea that has brought new versatility to industrial recording, a Carrier Preamplifier (A) is shown above in position to plug into a Driver Amplifier in framework with Power Supply (B) which are normally already in place in the Basic Cabinet Assembly.

The identical design principles of the four-channel system are provided in the two-channel, the only difference being the number of channels.

Sanborn "150" Recording Systems that put to use the original design concept of amplifier interchangeability (illustrated at the left) start with either a four-channel or two-channel standard Basic Assembly, to which the user adds whatever selection or combination of pre-amplifiers (A) are needed for his recording problem. The standard Basic Assemblies comprise a metal Cabinet, Recorder, and a built-in Driver Amplifier and Power Supply (B) for EACH channel. Presently available Preamplifiers are: AC-DC, Carrier, DC Coupling, Servo Monitor, Log-Audio, and Low Level Chopper.

Advantages common to ALL Sanborn Recorders are: inkless recording (by heated stylus) on plastic coated strip chart paper, and in true rectangular coordinates . . . high torque galvanometer movement . . . time and code markers . . . numerous paper travel speeds.

2-CHANNEL

"150"

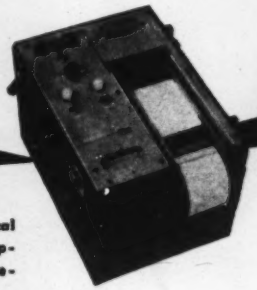
COMPLETE FOUR-CHANNEL SYSTEM FOR USE WITH ANALOG COMPUTERS

This "150" system consists of a Cabinet Assembly, a four-channel Recorder, and *two* dual channel DC Amplifiers. Each amplifier is complete with a common power supply. Each measures and records two separate single-ended signals, at sensitivities between one and one hundred volts per centimeter. The *two*-channel version of this system will comprise Cabinet, *two*-channel Recorder, and one dual channel amplifier.

"150"

SINGLE-CHANNEL RECORDER

A compact, lightweight unit for use when only one channel is required — provides permanent, inkless recording in *true* rectangular co-ordinates; *five* paper speeds (5, 10, 25, 50, 100 mm/sec.); *extra* stylus for either manual or remote timing and coding marks. Designed for simple, patch cord connection to *any* of the several "150" preamplifiers (plus driver amplifier and power supply), available soon in portable metal cases.



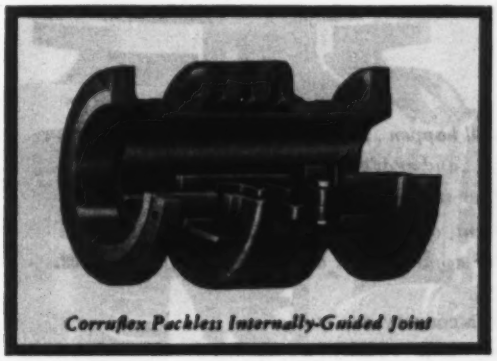
Ask, also, for a copy of the *Right Angle* — a Sanborn publication devoted to oscillographic recording in industry.

Catalog and technical data on all "150" equipment available on request.

SANBORN COMPANY

Industrial Division

CAMBRIDGE 39, MASS.

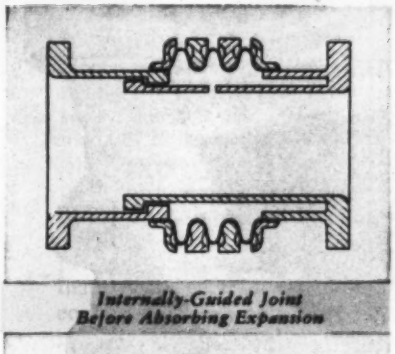


Corruflex Packless Internally-Guided Joint

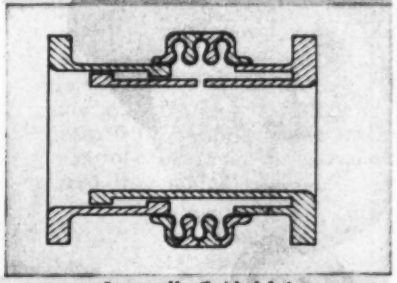
RIGID

AGAINST ALL MOTION EXCEPT AXIAL . . . . .

THE *Corruflex* INTERNALLY-GUIDED JOINT



Internally-Guided Joint Before Absorbing Expansion



Internally-Guided Joint After Absorbing Expansion

One of many reasons why Corruflex Packless Expansion Joints are so widely used by progressive engineers is the completeness of the Corruflex line. There is a Corruflex joint to absorb pipe expansion under *any* piping condition.

Suppose an engineer wants a joint which provides rigid construction against all movement except axial movement. ADSCO has the perfect solution — the Corruflex Internally-Guided Expansion Joint. No maintenance required because it is packless. Joint is built with an internal sleeve of heavy wall construction for effective guiding. Inner end of sleeve has a guide ring riding on a machined bore to insure true axial movement. Limit stop prevents the joint from being extended beyond its predetermined limit.

ADSCO makes the most complete line of expansion joints of any manufacturer in the world. That means complete engineering! Come to ADSCO for the *right* joint.

Don't let pipes get out of line

Use ADSCO Alignment Guides with ADSCO Expansion Joints. Cylinder is 12″ long in all sizes, permitting pipe movement of 10″. Damage to insulation prevented by ample clearance between guiding cylinder and pipe.

ADSCO ENGINEERED PRODUCTS

EXPANSION JOINTS • HEAT EXCHANGERS • STEAM TRAPS • STRAINERS • SEPARATORS • METERS

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PLANTS: NORTH TONAWANDA, N. Y., AND RICHMOND, CALIF.

hi!

Any moment, now, it will happen . . . a little hand reaching . . . a puppy-tail wagging . . . and suddenly a boy and his new dog will be tumbling together in the beginning of love.

Here, in such a moment, out of the heart's deep need for love begins the reaching for security that all of us need all our lives.

Only in the freedom of a country like ours can each one of us have the privilege of working for the security of those we love. And building that security yields a double reward: happiness in our homes and strength for America.

For the strength of our country is simply that of one secure home joined to another's.

Your security and that of your country begin in *your* home.

Saving for security is easy! Read every word—now!

If you've tried to save and failed, chances are it was because you didn't have a *plan*. Well, here's a savings system that really works—the Payroll Savings Plan for investing in U.S. Savings Bonds. This is all you do. Go to your company's pay office, choose the amount you want to save—a couple of dollars a payday, or as much as you wish. That money will be set aside for you before you even draw your pay. And automatically invested in Series "E" U.S. Savings Bonds which are turned over to you.

If you can save only $3.75 a week on the Plan, in 9 years and 8 months you will have $2,137.30.

United States Series "E" Savings Bonds earn interest at an average of 3% per year, compounded semiannually, when held to maturity! And they can go on earning interest for as long as 19 years and 8 months if you wish, giving you a return of 80% on your original investment!

Eight million working men and women are building their security with the Payroll Savings Plan. For your sake, and your family's, too, how about signing up today? If you are self-employed, ask your banker about the Bond-A-Month Plan.

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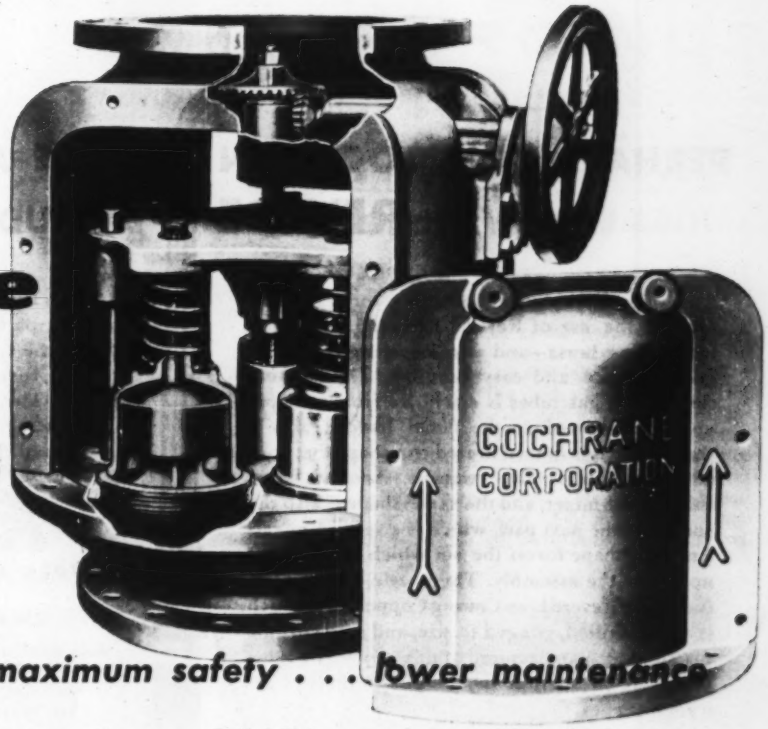
Cochrane
MULTIPORT RELIEF VALVES



Assure

dependability . . . maximum safety . . . lower maintenance

Cochrane Multiport Valves guarantee uniform regulation of line over-pressure with maximum safety. The use of multiple *vapor cushioned* discs, made of corrosion-resistant metals, prevents possible valve failures. Valves will not rust, freeze or jam. Valves operate automatically and positively.

As set pressure is exceeded, the *vapor cushioned* valve discs ride open gradually with the over-pressure . . . eliminates heavy pulsations in the line that would be transmitted to heater and other equipment. When only the *exact amount* of over-pressure is bled off, valve discs close gradually and *gently* to pre-set pressure, eliminating back surge, blowdown or vapor hammer.

Vertical, horizontal or angle Multiport Valves are available for pressures 0 to 25 psig, 0 to 60 psig, 0 to 100 psig. Hand wheel or chain wheel control easily accomplishes valve adjustment from zero to required pressure. Cochrane Multiport Relief Valves are for pressure or back pressure relief to atmosphere service, but also have application in closed systems as Check Valves or Differential Pressure Spill-over Valves, also as Vacuum Breakers. *Write for Publication 5200.*

Other Cochrane Processes

HOT ZEOLITE SOFTENERS

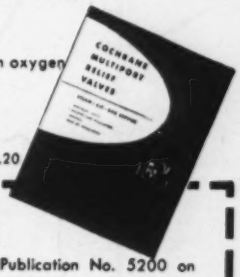
Complement present Hot Process Softeners by utilization of high temperature ion exchange resins. Provide water of zero hardness; lower alkalinity; minimize carbon dioxide and silica. Effect substantial savings by eliminating soda ash and reducing amount of phosphate used. Publication 4801.

DEMINERALIZERS

Cochrane ion exchange units deliver a continuous supply of demineralized silica-free water at extremely low cost. Publication No. 5800.

DEAERATORS

Delivers deaerated water with an oxygen content not to exceed 0.005 cc. per litre—less than 7 parts per billion! Publications 3305 and 4643.



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COCHRANE CORPORATION
3142 No. 17th St., Phila. 32, Pa.

Please send me a copy of Publication No. 5200 on Cochrane MULTIPORT VALVES. I would also appreciate the following publications:

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Demineralizers • Hot Process Softeners • Hot Zeolite Softeners • Dealkalizers • Reactors • Deaerators • Continuous Blow-Off • C-B Systems • Specialties

PERHAPS YOU, TOO, CAN MAKE A BETTER PRODUCT WITH REVERE EXTRUDED SHAPES

This new Oxy-Acetylene welding torch is notable for the use of Revere Extruded Shapes in free-cutting brass—and also for its light weight, good balance, and easy handling. The connection for the gas tubes is machined from a shape, and silver-brazed to the fluted handle, also a shape, which is in turn brazed to a shape that contains the needle valve controls. Another fluted shape is the mixer, and the same shape is also the source of the next part, which is a second mixer. Another shape forms the nut which attaches the nozzle to the assembly. The nozzle, by the way, is made of Revere Free-Cutting Copper Rod, which is upset, drilled, swaged to size, and then chrome plated. The manufacturer of this new torch came to Revere to learn about the possibilities of extruded shapes.

If you have a product whose design includes a part or parts calling for extensive machining along the longitudinal axis, such as flutings, curves, recesses, remember Revere Extruded Shapes. They can greatly reduce machining time, lessen scrap, lower production costs, and speed up output. See the nearest Revere Sales Office.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

SEE "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

New Model 30 Aircraft Welding Torch, made by National Welding Equipment Co., 218 Fremont St., San Francisco 5, Calif. The multiple mixer design is patented. Weight, 8½ oz. with medium nozzle. Made almost entirely from Revere Metals in extruded shapes and rod.

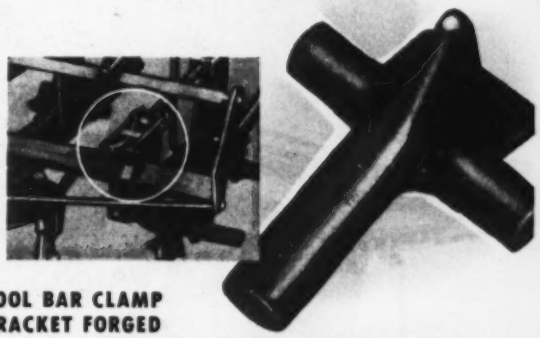
USE MORE FORGINGS

get more Cost Reductions at the point of assembly

A thorough "going-over" of each part of a product or mechanism to consider whether it can be or should be more efficiently produced will inevitably yield some worthwhile reductions in cost at the point of assembly. This process of examining each component may be accomplished in less time and with less effort than would first appear with the aid of Drop Forging "Problem Parts Charts" for design engineers, production executives, metallurgists and purchasing agents. These charts utilized along with the experienced skill of a forging engineer working with one or more members of a production team often reveal cost reducing possibilities heretofore undiscovered. Ask a forging engineer for a complete set of Problem Parts Charts.

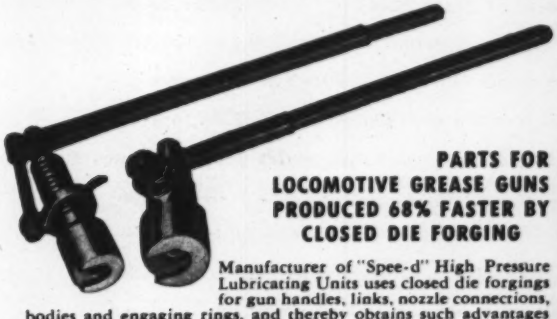
STRONG, TOUGH, DENSE FORGED PARTS CUT REJECTIONS 26.4% FOR MANUFACTURER OF A VARIETY OF QUARRYING AND MINING EQUIPMENT

These drilling machine parts are closed die forgings, used to obtain greater strength, reduction of dead weight, better physical properties, and reduction in percentage of rejects to a minimum.



TOOL BAR CLAMP BRACKET FORGED TO SHAPE, REDUCES COST OF MACHINING 12%

Key part of trigger latch for tractor-mounted cultivator, formerly a three-piece welded assembly built up from bar stock, now closed die forged in one piece. Results in increase of approximately 60% in number of parts completed per hour. Forging eliminates all but a simple drilling operation—no jigs, assembly or welding operations are needed.



PARTS FOR LOCOMOTIVE GREASE GUNS PRODUCED 68% FASTER BY CLOSED DIE FORGING

Manufacturer of "Spee-d" High Pressure Lubricating Units uses closed die forgings for gun handles, links, nozzle connections, bodies and engaging rings, and thereby obtains such advantages as greater strength and uniformity of physical properties, reduction in dead weight, and a 68% increase per hour in the production of finished parts.

This book tells why forgings are used for the toughest workloads. Engineering, production and economic advantages obtainable with closed die forgings are presented in this reference book on forgings. Write for copy today or attach coupon to your business letterhead.

A New Movie entitled, "Forging in Closed Dies," reveals all aspects of the closed die forging process of forming parts. Represents over two years of planning and research. It is available for industrial training, sales training, instruction in engineering and metallurgy courses in the college level and for technical, industrial and engineering societies. Write for information about loan of film without cost.

DROP FORGING ASSOCIATION
605 Hanna Building
CLEVELAND 15, OHIO

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605 Hanna Bldg., Cleveland 15, Ohio

Please send 64-page booklet entitled, "Metal Quality" —How Hot Working Improves Properties of Metal," 1953 Edition.

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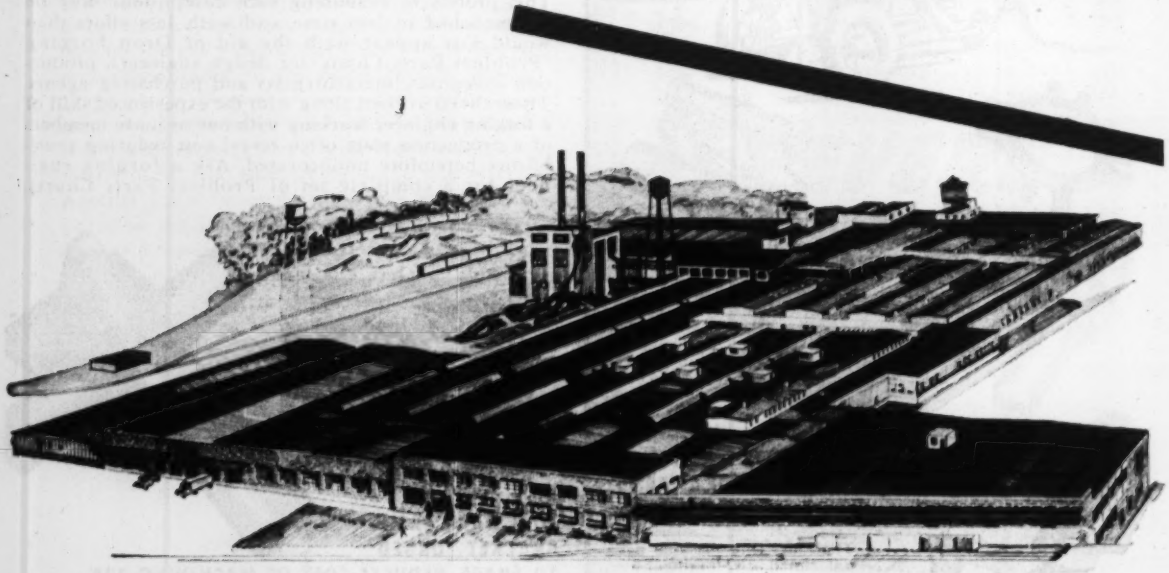
one WICKES

generates steam in new B. F. GOODRICH



At the Oaks, Pennsylvania, tire and tube plant of The B. F. Goodrich Company, part of a $50,000,000 expansion program now in progress includes modernization of the plant's power facilities. A new WICKES 3-Drum Steam Generator (shown in the blueprint) will help supply the steam necessary for the production of the 5,500,000 tires per year at this new plant. The unit will produce 110,000 lbs. of steam per hour at 300 lbs. pressure. It is equipped with an air heater and super heater. Like so many other industries and institutions that depend on steam for heat and power, B. F. Goodrich knows that WICKES Boilers are a reliable source of low-cost steam. WICKES will design and build water tube plants to specifications for any practical size and pressure. WICKES also offers a wide choice of auxiliary equipment so that you get not only the best steam generator, but also the best correlated equipment. Consult your nearest WICKES representative or write us today.

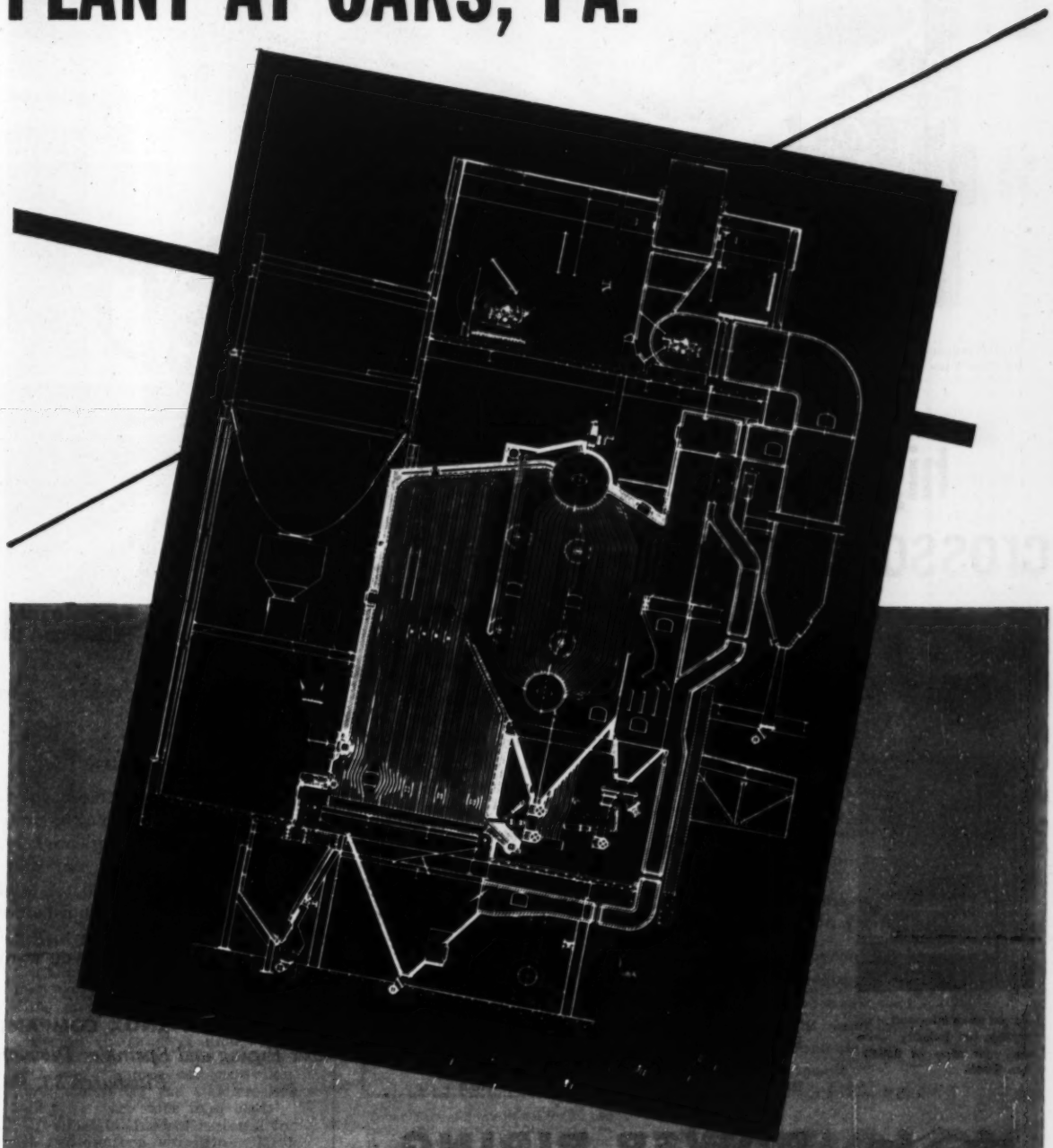
ONE YOUR YEAR

THE WICKES BOILER CO.

DIVISION OF THE WICKES CORPORATION • SAGINAW, MICHIGAN

two drum boiler

PLANT AT OAKS, PA.



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184

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Whether you need a complicated, high pressure piping system, such as this one, or a relatively simple job, you can always turn the entire job over to us. And we'll follow through . . . in close cooperation, of course, with your consultants or your own organization.

You'll get the benefit of modern shop facilities for hot and cold bending, welding and fabricating all types of piping. A metallurgical research laboratory which assures you of the latest developments in high pressure, high temperature piping. The most modern testing equipment to assure the soundness and strength of the piping.

Plus a complete service force with modern machinery for field work and erection . . . and the necessary manpower to handle jobs of any size.

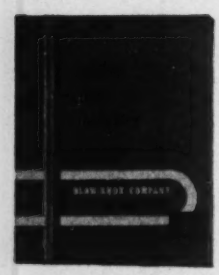
What service do you require?

We will, for instance, (1) engineer, fabricate, and erect your job . . . or (2) simply fabricate and erect . . . or (3) fabricate only.

Our engineers will quote from your drawings . . . or, when desired, make a field study of your piping requirements before quoting.

Just let us know what service you want . . . and we'll provide it.

BLAW-KNOX COMPANY
Power Piping and Sprinkler Division
Pittsburgh 33, Pa.



To get more information on piping for industry write for your copy of Bulletin No. 2443.

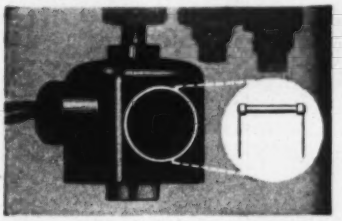
BLAW-KNOX

POWER PIPING

Complete prefabricated power piping systems for all pressures and temperatures . . . plus complete line of functional spring hangers • rigid hanger assemblies • overhead roller assemblies • supports • vibration eliminators

News About Created-Metals

Thermistors Provide Vital Time Delay

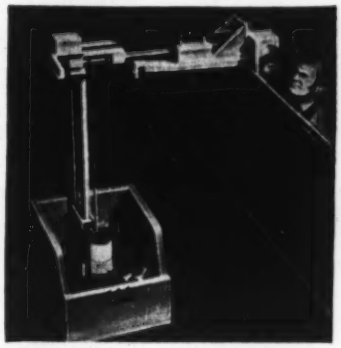


Smoky starts, puff-back and flutter in oil burners were checked by using a Carboloy Thermistor in the burner's electrical control.

The Thermistor delays the opening of a solenoid valve until the combustion chamber is ready to receive properly aerated oil. A mechanical timer is eliminated, and the cost of the unit reduced.

Thermistors are the most thermally sensitive resistor material known. Their resistance – unlike metals – changes negatively with temperature increases. They are ideal for temperature compensation, temperature detection, warning devices and controls. For more information, write: Carboloy Department of General Electric Company, 11133 E. 8 Mile Street, Detroit 32, Michigan.

Hevimet Containers Stop "Hot Atoms"



Containers made of Carboloy Hevimet are making the job of handling and transporting radioactive materials easier and safer.

Because Hevimet is almost 50% heavier than lead, and provides 40% more gamma ray protection, these containers are smaller, less bulky . . . yet safer than lead.

Hevimet is an ideal material for all radioactive shielding. It is readily machinable, dimensionally stable and of high tensile strength For more information, write: Carboloy Department of General Electric Company, 11133 E. 8 Mile Street, Detroit 32, Michigan.

Give your customer more for his money

SLOW DOWN WEAR

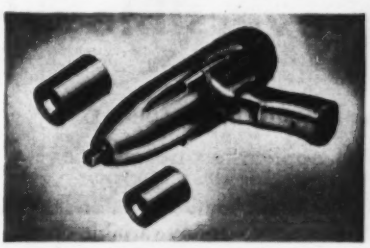
with Carboloy® cemented carbides

Wear is the common denominator of all equipment, reducing life, accuracy and greatly increasing costs.

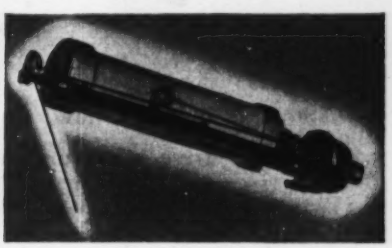
To slow down wear, many product and machine designers are applying Carboloy cemented carbides. In most instances, wherever friction, corrosion, erosion or abrasion are met, Carboloy cemented carbides can increase durability *many times over.*

These three case histories are typical of many more which may suggest important wearproofing possibilities for your own machines and products.

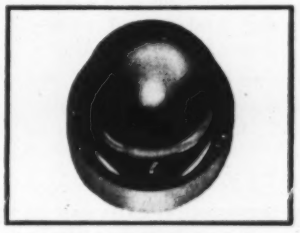
Look over *your* products and call upon the Carboloy Engineering Appraisal Service for expert assistance. We will work with you in selecting and applying the cemented carbide that will best solve *your* wear problem. This service is free. Please write.



Power socket wrenches, equipped with carbide inserts, outlasted ordinary wrenches a minimum of 15 to 20 times; eliminated screw, product damage caused by wrench slippage; sharply cut socket replacement costs and production line downtime.



In textile mills, threads traveling at high speeds quickly cut through steel or porcelain guides. Carbide guide ring inserts, used to resist such wear, lasted 50 to 100 times longer. They also greatly reduced thread snagging and snapping, spoilage and downtime.



Subsurface pumps in oil wells use balls and seats of Carboloy cemented carbide to resist acids and abrasive sands found in crude oil. Carboloy balls and seats outlast steel 20 times; maintain sphericity under severest conditions of impact and pressures.

Put These Outstanding Characteristics To Work In *Your* Plant:

- High abrasion resistance
- High corrosion resistance
- High erosion resistance
- High heat resistance
- High impact strength
- Non-magnetic
- Light weight (where desired)

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY
11133 E. 8 Mile Street, Detroit 32, Michigan

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

Phantom view of driving and driven members.→

New *Gýrol* Fluid Drive is reversible while in motion!

American Blower's new, class 2, adjustable-speed fluid drive offers unlimited application possibilities!

NEWEST member of the American Blower Gýrol Fluid Drive line, this versatile unit can be reversed while in motion—at any variable operating speed—by merely reversing the direction of rotation of the motor!

You'll find many other big advantages in this compact, self-contained unit for shockless, adjustable-speed control of fans, blowers, centrifugal pumps and compressors—and a wide variety of other industrial uses! Check the features of this new Gýrol Fluid Drive and see if it can be used in your own plant. It's a safe bet you will find several money-saving applications!

Get complete information about the American Blower Class 2, Adjustable-Speed Gýrol Fluid Drive from your nearest American Blower Branch Office. Or write us direct, Dept. 180-7, for your free copy of Bulletins 9419 and 9519. Do it, today!

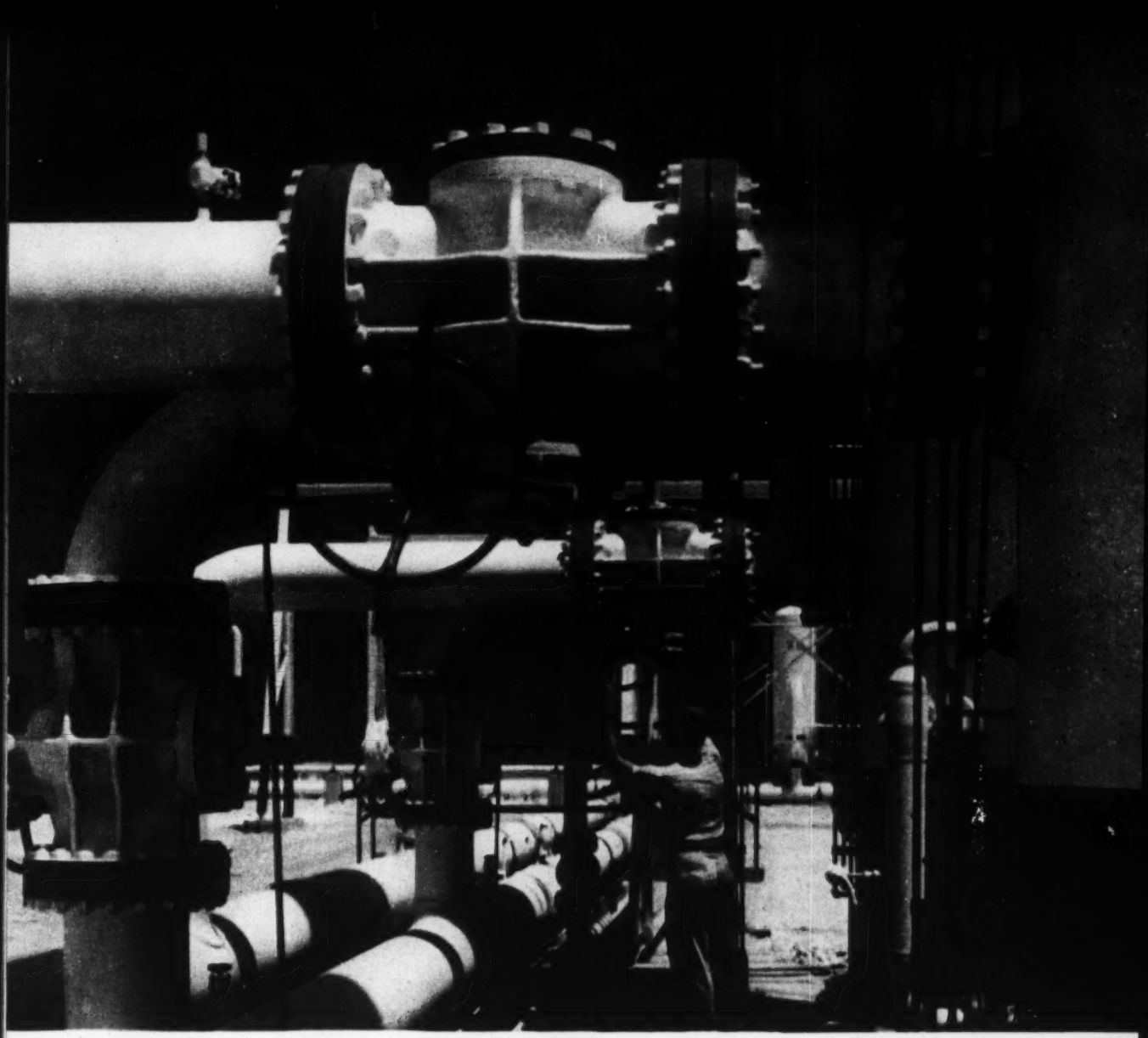
FEATURES

- Can be reversed while in motion by reversing motor
- Speed range 5-1
- Across-the-line starting on many applications
- Motor can reach full speed before engaging load
- A compact, self-contained unit
- Trigger-action response—adjustable speed
- Speed may be controlled manually or automatically
- Six sizes, 7½ thru 800 hp—speeds up to 1800 rpm

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN • CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary Corporation

YOUR BEST BUY AMERICAN BLOWER GÝROL FLUID DRIVES

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS



Certainly . . . no question the valve will operate when it's needed if it's a Rockwell-Nordstrom. It isn't necessary to experiment with valves—Rockwell has done the research for you. The originator of lubricant-sealed valves, with more valves in more different services than any manufacturer, Rockwell can fit the proper valves and lubricants to your application.

There is no substitute for Rockwell-Nordstrom experience—use it to save money on valves. *Rockwell Manufacturing Company, Pittsburgh 8, Pennsylvania.*

THREE WAYS
THE NORDSTROM LUBRICANT WORKS

Lubricant surrounds each valve port with a vapor tight pressurized seal. **Nordstrom valves stay tight.**

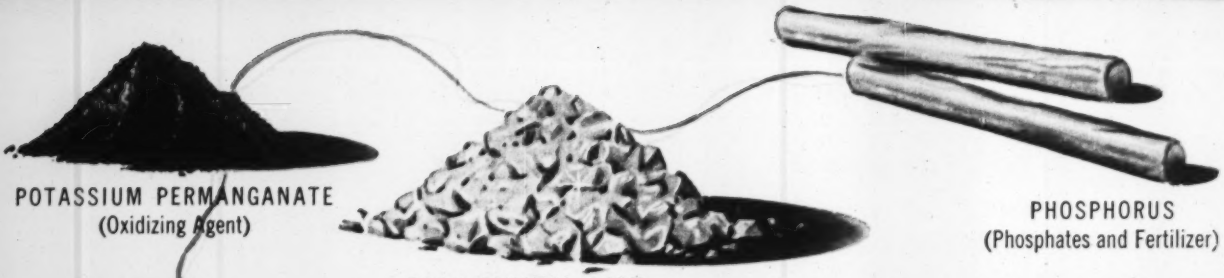
Lubricant acts as hydraulic jack—a fast quarter-turn to open or close. **Nordstrom valves operate quickly.**

Lubricant coats the plug for sliding action—no wear-producing wedging. **Nordstrom valves operate easily.**

Rockwell

NORDSTROM VALVES

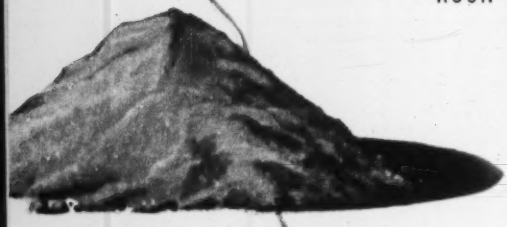
Lubricant Sealed for Positive Shut Off



POTASSIUM PERMANGANATE
(Oxidizing Agent)

ROCK CRYSTAL SALT
(Brine)

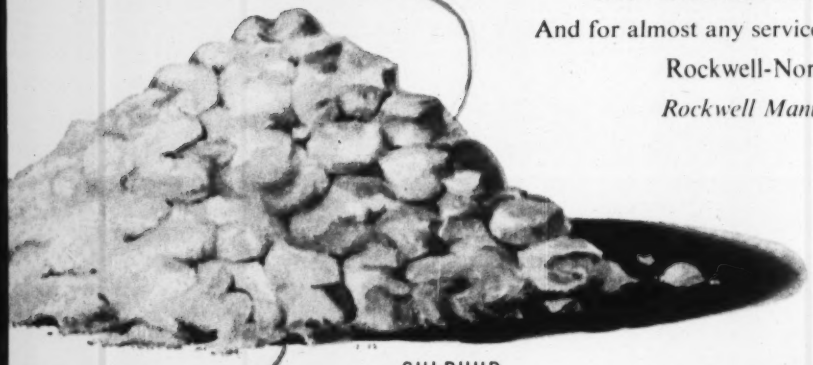
PHOSPHORUS
(Phosphates and Fertilizer)



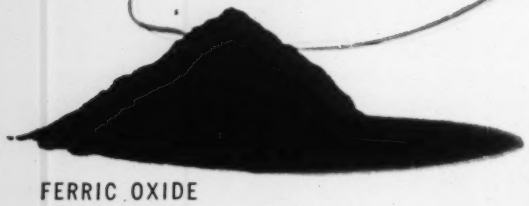
CLAY SLIP
(Ceramics)

POTASSIUM DICHROMATE
(Oxidizing Agent)

BAUXITE
(Aluminum)



SULPHUR



FERRIC OXIDE
(Paints)

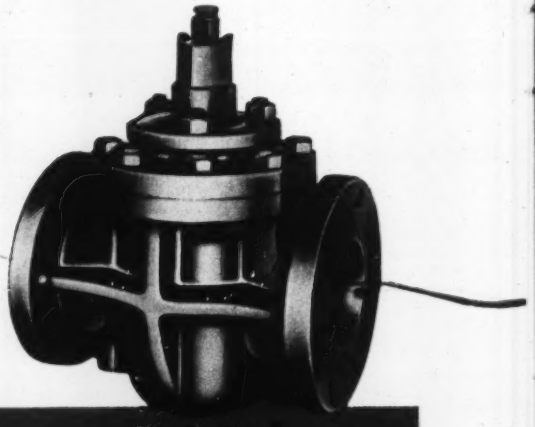
HOW TO END SLURRY WORRY

Slurries and entrained solids eat the heart right out of many types of valves—and incidentally eat up process industry profits at the same time.

The point is that all solids are essentially abrasive, gritty, erosive. They tend to pit ordinary valve seats, or channel leakage paths, and replacement costs mount.

But not necessarily. Rockwell-Nordstrom valves have been proven to outlast other valves in many difficult services, like those shown here.

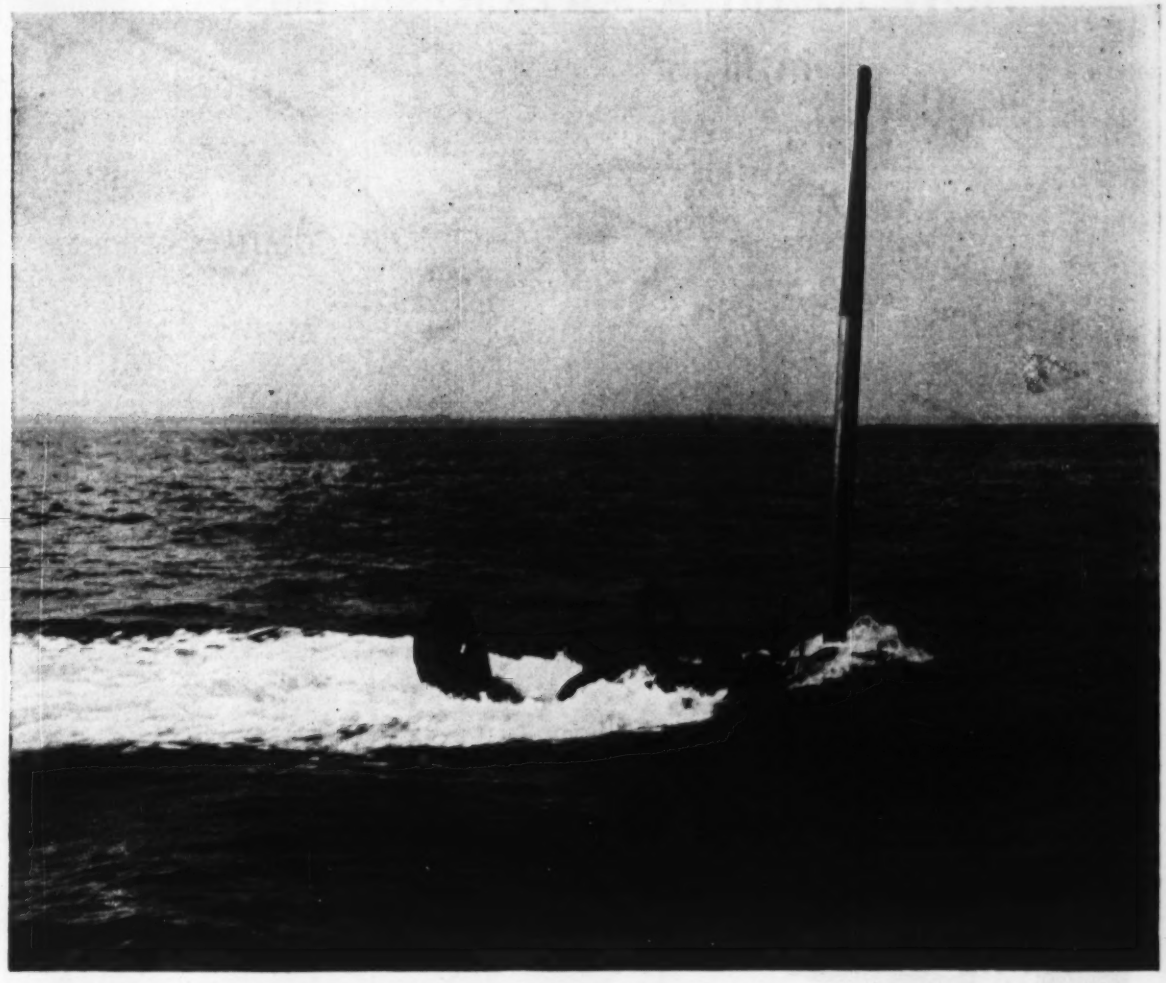
The reason is this: there's no exposed seat to wear away; instead there's a pressure seal of lubricant, and the essential points of closure are out of the path of flow. There are no valve body pockets to catch sediment either—just smooth, straight-through flow. And for almost any service, there's a correct and tested genuine Rockwell-Nordstrom lubricant. Get the facts from *Rockwell Manufacturing Company, Pittsburgh 8, Pa.*



Nordstrom Valves

Another Quality ROCKWELL Product

Here's a picture of some SPECIAL ALLOY STEEL



—and there's much more to it than appears on the surface

Only a stainless steel periscope tube, and some special navigational apparatus, shows above water. But below, a wonderfully compact mass of fighting machinery—literally packed with special steels and electrical alloys. *With* them, the ship is almost human. *Without* them, it has no eyes, ears, power . . . or usefulness. ● When *you* have to combat corrosion, heat, wear or great stress—or require unique electrical properties—check with us. ***Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa.***

Warehouse stocks of Allegheny Stainless carried by all Ryerson plants

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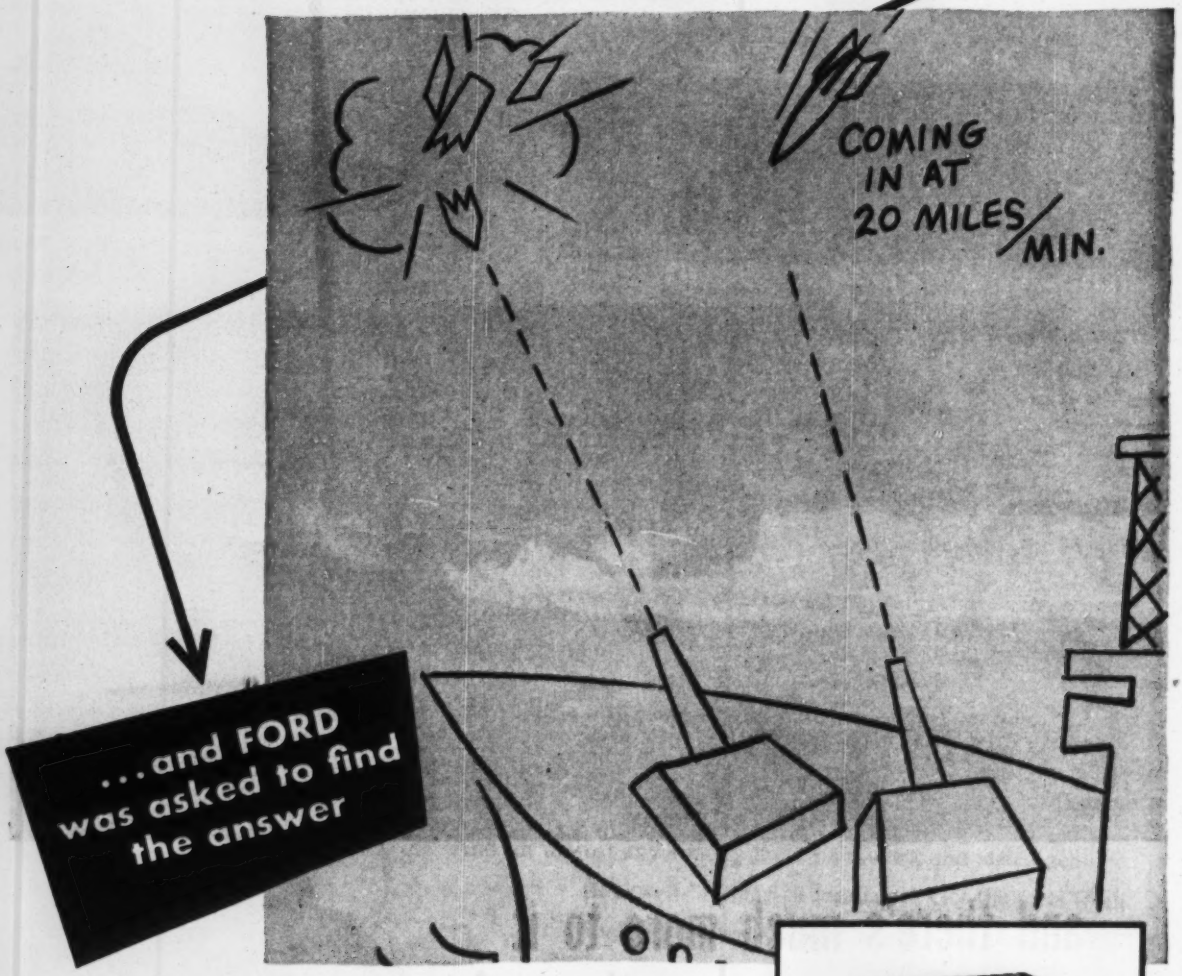
W&O 4148-B

PIONEERING on the Horizons of Steel

Allegheny Ludlum

HOW TO HIT A SUPERSONIC MISSILE in flight



An enemy guided missile comes winging towards our task force . . . at speeds of up to 20 miles a minute. What kind of computer can predict and compute the necessary data fast enough to shoot down the missile . . . and be reliable every time? That was the problem posed to Ford Instrument Company engineers . . . and in cooperation with the Navy, they found the answer. Compact equipment, housed in easy-to-service units . . . that stand at the front line of our defense.

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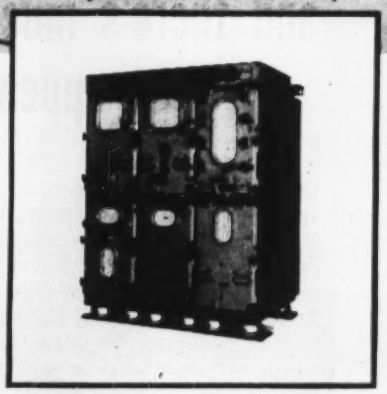

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DIVISION OF THE SPERRY CORPORATION

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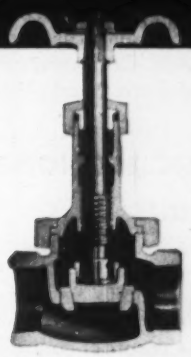
Choose from complete lines of Walworth Bronze Valves – including gate, globe, angle, check, and lubricated plug types. Walseal® Bronze Valves and Fittings are also available for making silver-brazed joints.

For full information on Walworth Bronze Valves and Fittings, call your Walworth Distributor, nearest Walworth Sales Office, or write to Walworth Company, General Offices, 60 East 42nd Street, New York 17, N. Y.



Parts are carefully machined and finished to close tolerances, thereby assuring accurate fit and alignment under all conditions. Sectioned valve is Walworth No. 225P Bronze Globe Valve with stainless steel plug-type seat and disc, heat-treated to a minimum of 500 Brinell hardness.

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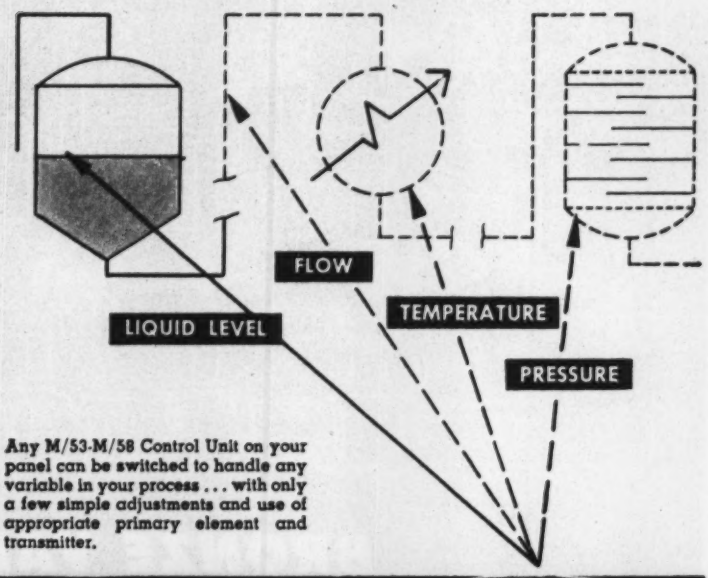
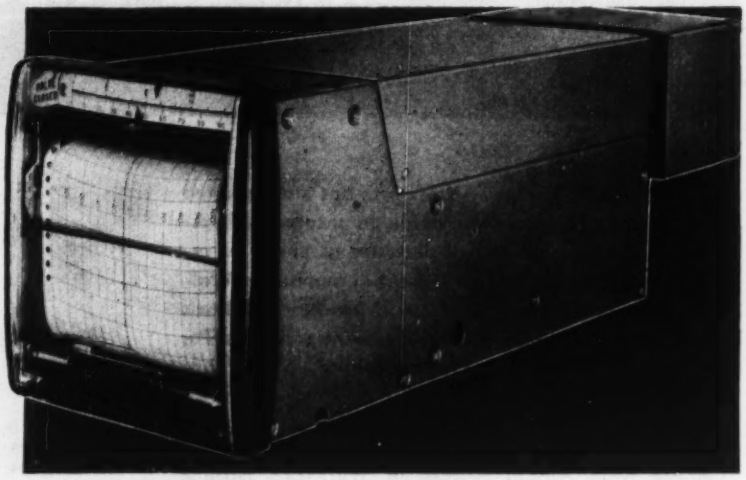
Whether you favor graphic, console, or conventional mounting, you can cut instrument overhead at every stage, step-up efficiency in every operation, with the Foxboro M/53-M/58 Recorder-Controller. Write for complete information. The Foxboro Company, 968 Neponset Ave., Foxboro, Mass., U.S.A.



Any M/53-M/58 Control Unit on your panel can be switched to handle any variable in your process . . . with only a few simple adjustments and use of appropriate primary element and transmitter.



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- ★ THEY COST NO MORE THAN OTHER ELBOWS.

As shown in the illustration above, Midwest "Long Tangent" welding Elbows have straight ends equal to ¼ of the nominal fitting diameter (a 12" elbow has tangents 3" long). For the reasons listed at the left, substantial savings are made on many piping systems by using Midwest "Long Tangent" Elbows. For more information about them, write for Catalog 54.

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LimiTorque Valve Controls

◀ Heat-treating and physical testing equipment shown at left is used for quality control of welding operators and for development of new welding procedures.

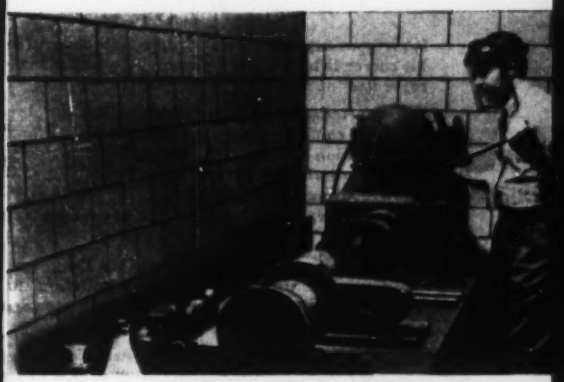
▲ This Rockwell hardness testing machine measures the hardness of weld specimens as a guide to proper procedures for heat-treating of welds.

Daily rigid testing is your insurance of quality welds in

NAVCO FABRICATED PIPING

At Navco, a continuous parade of weld specimens are processed in the new, modern physical-chemical testing laboratory. It is here that weldments are studied metallographically and tested physically—all on a rigid schedule of quality control practices. Navco customers have benefited from progressive quality control practices for more than 40 years; they have come to know that piping installations, engineered, fabricated and erected by Navco, are precise, accurate and dependable.

Call on NAVCO for your next piping job.



▲ A laboratory technician cuts a sample from a pipe weld prior to grinding and polishing for metallographic examination.

▲ Here a weld specimen is etched to outline the grain structure for further metallographic study.

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The Constellation project started in 1939, developed into a family of commercial and military aircraft. The Super Constellation now flies on 18 airlines throughout the world. Each month this year a new airline starts Super Constellation service. Military versions of the plane are in service with the U. S. Navy and U. S. Air Force as transports and radar search planes.

Production orders already extend into 1956. And in development: turbo-prop Super Constellations to continue Lockheed leadership in rapidly expanding passenger and cargo transport fields.

This means stability to a career-conscious engineer, whether you work on the Super Constellation or one of Lockheed's fighter, bomber, trainer, vertical riser or nuclear energy projects. (Example: when the F-94 project was completed, all Starfire engineers were assigned to the Super Constellation or one of the other projects. The Super Constellation family and Lockheed diversification made this possible.)

To engineers who look to their future, Lockheed also offers: 1) increased salary rates now in effect; 2) generous travel and moving allowances; 3) a chance for you and your family to enjoy life in Southern California.

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Aircraft experience is not necessary to join Lockheed. An engineering degree or equivalent experience qualifies you to receive transitional or on-the-job training—at full pay.

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Thermodynamics Engineers

Flight Test Analysis Engineers
to evaluate airplane and engine performance from flight test data. The position requires a degree in Mechanical or Aeronautical Engineering.

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for the development and application of special instrumentation in analyzing autopilots, acoustics and vibration. The position requires a degree in Electrical Engineering or Physics.

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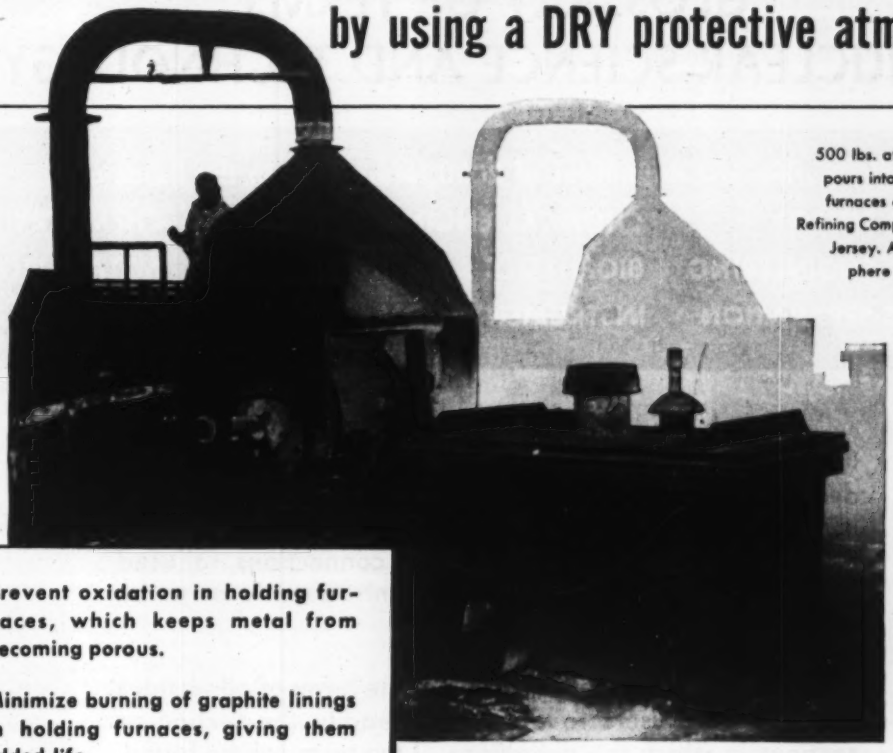
ASARCO solves 2 continuous casting problems by using a DRY protective atmosphere



500 lbs. at a time, melted bronze pours into these 2000-lb. holding furnaces at American Smelting & Refining Company, Perth Amboy, New Jersey. A DRY protective atmosphere prevents metal porosity caused by oxidation.

1 **Prevent oxidation in holding furnaces, which keeps metal from becoming porous.**

2 **Minimize burning of graphite linings in holding furnaces, giving them added life.**

This Lectrodryer extracts every bit of harmful moisture from nitrogen protective atmosphere gas fed to ASARCO's holding furnaces.

Melted bronze is held at 2300° in holding furnaces until tapped into a continuous casting. An inert gas atmosphere (nitrogen) covers the melt with a protective blanket.

Moisture (ordinary humidity) in the protective atmosphere would cause oxidation of the metal. But this can't happen here, because the nitrogen passes through a Lectrodryer* after leaving the gas generator. Harmful moisture is extracted, and the gas is safe to enter the furnace.

Whenever a protective atmosphere must be DRY . . . really DRY . . . you should consider using a Lectrodryer. These machines can DRY air and other gases in volume to dewpoints lower than −100°F. Ask your gas generator supplier. He's familiar with Lectrodryers and probably will recommend one if you have a moisture problem.

Data Available—Write for *Because Moisture Isn't Pink*, a booklet describing Lectrodryers of all types and how industry is using them. Pittsburgh Lectrodryer Corporation, 335 32nd Street, Pittsburgh 30, Pennsylvania.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux-Liege.

LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

LECTRODRYER

* REGISTERED TRADEMARK U.S. PAT. OFF.

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It includes an alphabetical listing of the terms of all sections which enable users to determine readily the section or sections in which the definitions of the term will be found.

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Before publication, all entries were circularized for criticism and revised in the light of comments received.

It has the endorsement
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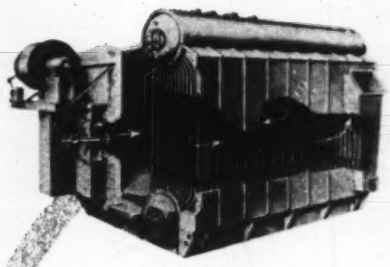

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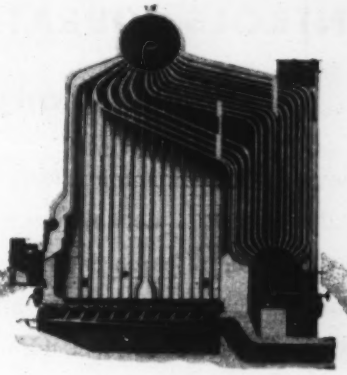

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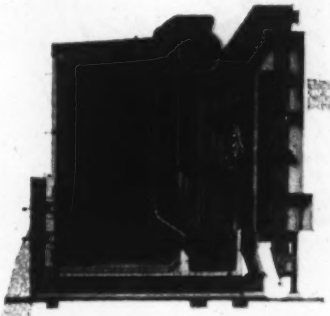
10,000 to 60,000 lb steam per hr . . . pressures to 475 psi . . . superheat to 200 F in larger sizes . . . for coal, oil or gas . . . bottom-supported, needs no outside supporting steel. Boiler is efficient over a wide range of output, and is easy to operate and maintain. All parts are readily accessible for inspection. Regardless of fuel, the same general cross-sectional arrangement of drums, convection bank and furnace cooling is used. Uniform design through each transverse section assures even water level in drum, and uniform expansion.



C-E Vertical-Unit Boiler, Type VU-55

50,000 to 120,000 lb steam per hr . . . pressures of 250 or 500 psi . . . superheat and heat recovery equipment if desired . . . for oil or gas . . . bottom-supported, needs no outside supporting steel. This boiler is of symmetrical design. Thus gas temperature is constant across the full boiler width. The narrow, high furnace . . . integral design of boiler and preheater . . . absence of exterior ductwork . . . compactness—all help the VU-55 achieve standards of performance closely approaching that of large central station boilers.

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C-E

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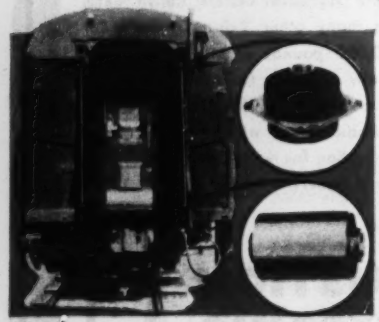
Over 27,000 designs and their variations from which to choose.



Another instance where Lord Vibration Control Engineering profits end-product manufacturers. To stop the rattle of the between-car Diaphragm and permit free movement, Lord Plate Form Mountings are used at the top and Lord Tube Form Mountings at the bottom of each Diaphragm Support on modern passenger cars.

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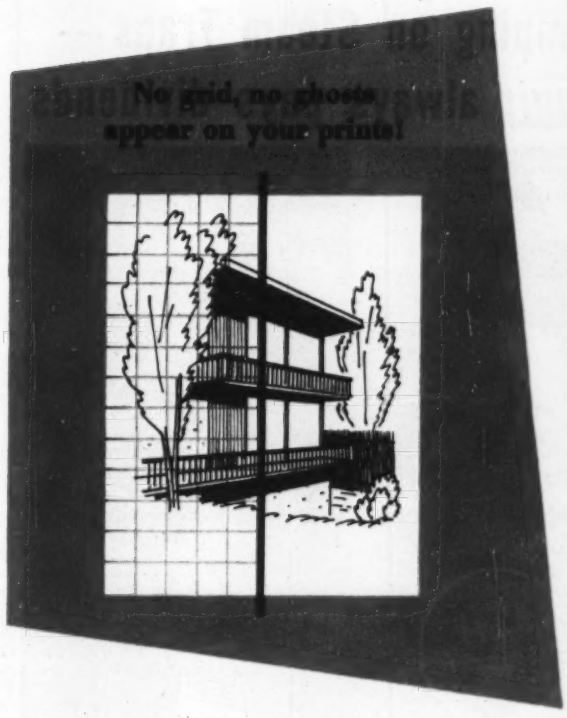

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Plant doubles production without appreciable increase in fuel costs

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Built-in Strainer Traps save fittings, labor, maintenance. Cost less than separate trap and strainer. Complete data in literature mentioned below.

When Standard Coat, Apron & Linen Service took over a previous linen service plant in Portland, Maine, the boilers could hardly handle the steam load. Mr. Tom Foley, General Mgr. called Files Steam Specialty Company, Armstrong Trap Representative in New England, to help correct the condition.

Under supervision of Mr. Ken Raymond, Chief Engineer, Armstrong traps were installed on *each* unit in the plant.

Results: doubled production with no appreciable increase in fuel consumption; higher machine temperatures; boilers easily handle the load.

This is a typical example of the efficiencies and economies possible through Armstrong unit trapping. Could your plant stand a shot in the arm? Call your Armstrong Representative, or write:

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—The "Steam Trap Book" contains 44 pages of trap data—selection, maintenance, trouble-shooting. Free on request. Or Consult Sweets or CEC.

ARMSTRONG STEAM TRAPS

"We've got an economy drive going..."

"Wow! Am I glad to get off my feet. Those cement floors at the exhibit hall were killing me!"

"Glad to have you stop by. Let's just relax for awhile."

"While we're sitting here, Roy, tell me something. I heard you talking about cutting costs with that fellow from the automobile plant. We've got an economy drive going and I'd like some more ammunition. For example: Wolverine Trufin*—why is that so economical?"

"Trufin is a natural for cutting costs. One-piece construction gives you more heat transfer area in less space. Retubing with Trufin saves the cost of new equipment, boosts output."

"It sounds better all the time, Roy. Keep going."

"Well, we've got the Wolverine Spun End Process†. We take a length of plain tube and, in one simple operation, fabricate it into the shape you need. Spinning can eliminate such operations as deep drawing, swaging, machining and assembly."

"That can save us plenty of time."

"Sure, Bill. You're an engineer—you've got to look at it that way. And you, Jim,—you're a P.A. You've got to consider convenience. You'll be interested in knowing that Wolverine produces tubing of copper (and its alloys), aluminum, and electric-welded steel—prime surface or finned. Then, too, we can give you production-line packaging—safe delivery, easy to handle, easy to store shipments. Remember too, Bill, that you can get technical help from our Field Engineering Service!"

DON'T FORGET: Only Tubemanship can produce such a sparkling economy story as this. You can get full information from our General Products Catalog. Just write, WOLVERINE TUBE, Division of Calumet & Hecla, Inc., 1483 Central Avenue, Detroit 9, Michigan.

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ontario.

† A PATENTED PROCESS RE. 22465
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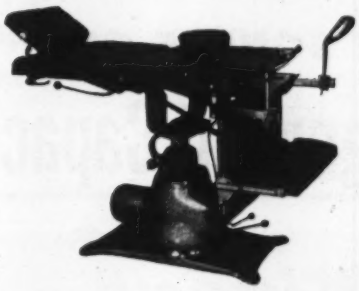
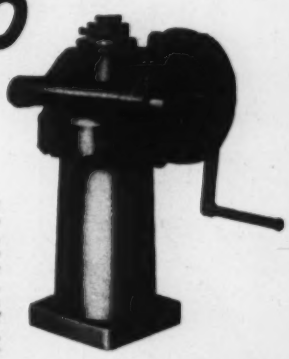
Choice of leading physicians is this motor-elevated medical specialists table made by Ritter Company. To minimize the discomfort of patients its tilting mechanism is Aetna bearing-equipped for effortless, smooth, quick adjustments without irritating jolting and jarring.



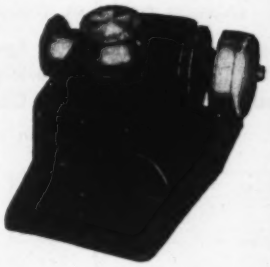
ARMCO

This drainage gate hoist made by Hardesty Division—Armco Drainage and Metal Products, Inc., may be installed in some isolated spot remote from repair service should trouble develop. That's one reason why it is Aetna bearing-equipped—why, even if not used for long periods of time, it will operate easily, efficiently and dependably.



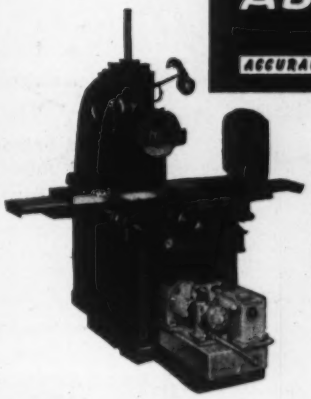
IDEAL

Ideal Windlass Company, manufacturers of deck machinery for pleasure and commercial boats, uses Aetna bearings in all models of their electric anchor windlasses to help handle anchor loads of 500 pounds and more in minimum space, at maximum speeds—to reduce wear on other working parts, save electric power and insure trouble-free, longer equipment life.



ABRASIVE

ACCURACY BOOSTS PRODUCTION



Abrasive Machine Tool Company makes sure its surface grinders have what it takes to stay on non-stop jobs with minimum maintenance and downtime by using Aetna bearings on the elevating screw in the head assembly of this No. 1218 type horizontal spindle grinder.

AETNA BEARINGS

bring important advantages to these fine products

Here are widely varied examples of Aetna bearing applications. Why are they used in such mechanically simple products as medical tables and drainage gate hoists? The answer is simple. Aetna bearings make any moving device—big or small, simple or complex—more efficient, more serviceable, more salable.

Consider your own product. Is it one of the many that still doesn't—but could—use bearings? If it is and if you want to put it out in front of competition, value-wise and sales-wise it might pay you handsomely to talk things over with Aetna. Write now while your mind is on your product's future.

Standard and Special Ball Thrust Bearings • Angular Contact Ball Bearings • Special Roller Bearings • Ball Retainers • Hardened and Ground Washers • Sleeves • Bushings • Miscellaneous Precision Parts.

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The Amerigear® patented fully crowned tooth form...

...IS THE SOURCE OF

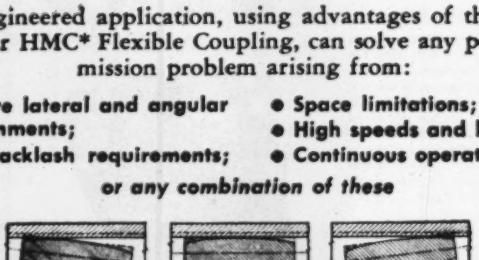
High Misalignment Capacity*

IN Amerigear® COUPLINGS

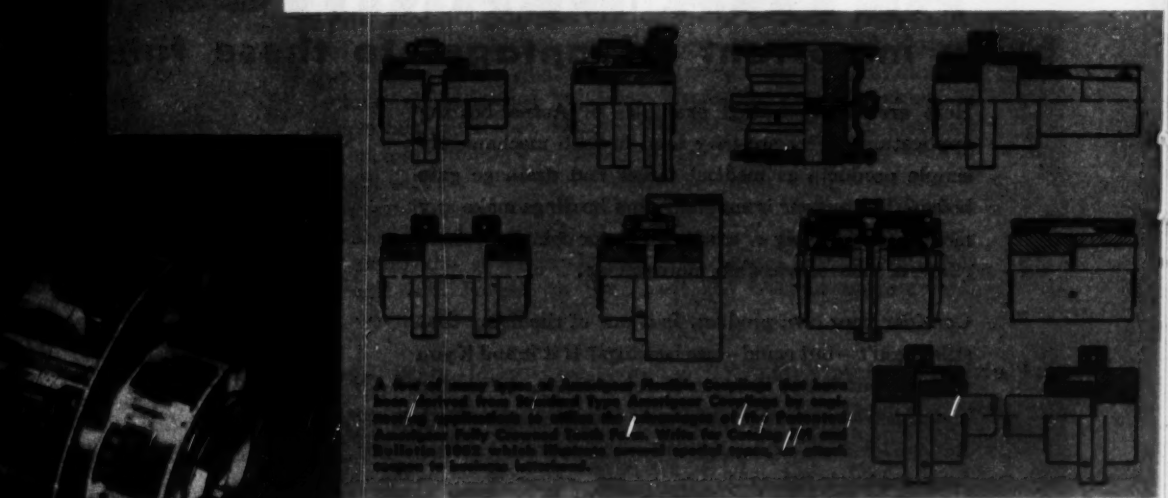
● An engineered application, using advantages of the Patented Amerigear HMC* Flexible Coupling, can solve any power transmission problem arising from:

- **Excessive lateral and angular misalignments;**
- **Tight backlash requirements;**
- **Space limitations;**
- **High speeds and loads;**
- **Continuous operation;**

or any combination of these



Comparison with gearing of conventional gear-type couplings shows how Patented Amerigear Tooth Form eliminates *tooth end loading* and simultaneously allows for both lateral and angular misalignment. Dotted lines indicate gear teeth of conventional gear couplings.



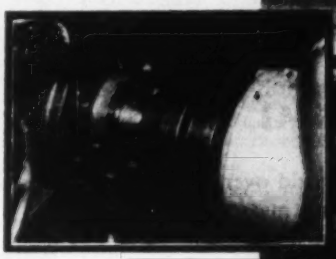
Amerigear® HMC* FLEXIBLE COUPLIN

One of several standard types embodying the Patented Amerigear Tooth Form

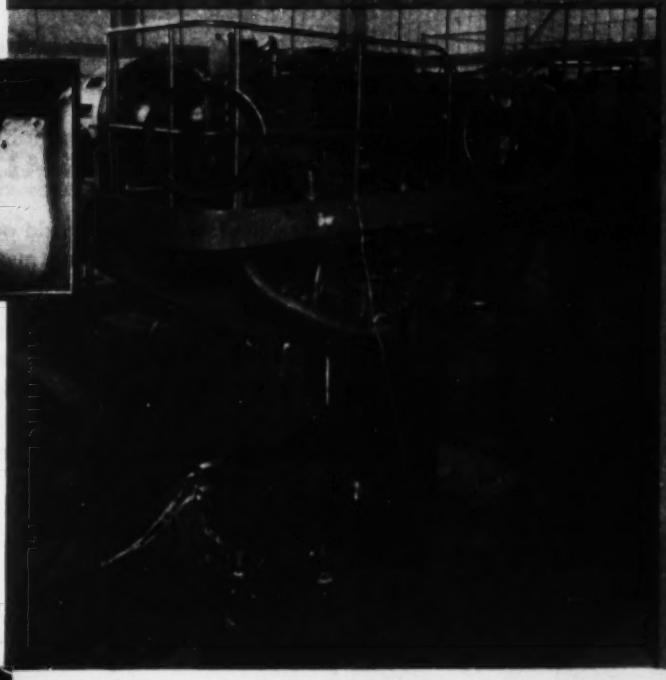
Patented and Patents Pending

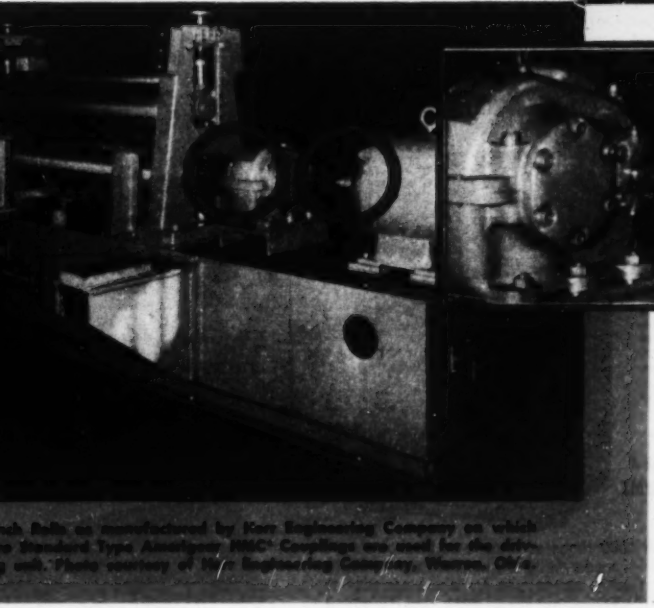
Amerigear® HIGH MISALIGNMENT CAPACITY* COUPLINGS

olve power transmission roblems for wide variety of metal vorking equipment!



n this application a Standard ype of Amerigear HMC* oupling is a vital part of the ump and motor drive units n a 350-ton capacity Bliss ydro-Dynamic Hot Nosing ress. The pump and motor rive unit operating at 1200 .p.m. provides hydraulic ressure to operate the press am. Every 10 seconds the operating load transmitted ncreases from 125 h.p. to 150 h.p. and is held for pproximately 2 seconds—thus, the load being trans-nitted fluctuates several times per minute. There are wo pump and motor drive units on this press. This s a typical example of how a Standard Type Amerigear HMC* Coupling is utilized to solve power transmis-ion problems arising from a fluctuating load, tight acklash requirement, space limitation, and lateral and ngular misalignment conditions.





One of several applications of Standard Type Amerigear HMC* Couplings installed on Pinch Rolls manufactured by Herr Engineering Company. In this application two Amerigear HMC* Couplings are used; one on the rotating shaft between the motor and the gear reducer, and another between the gear reducer and the roll end. Herr Engineering also use Standard Types of Amerigear HMC* Couplings for their Pay-off Reels, Take-up Reels, Slitters and other steel finishing equipment. In this application Amerigear HMC* Couplings with Patented Tooth Form are transmitting power under shock loading conditions. They minimize the effect of any lateral or angular misalignment which may occur, thereby reducing maintenance costs to an all-time low.

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merigear Engineers are available to assist in *engineering special applications* of the merigear Patented Crowned Tooth Form and for adapting Amerigear Standard ype HMC* Couplings to solve your power transmission problems. Write for atalog 501 and Bulletin 1052, or attach coupon to your business letterhead.

AMERICAN FLEXIBLE COUPLING COMPANY

ZURN

Originator of the famous Amerigear Patented Tooth Form

Affiliate: J. A. Zurn Mfg. Co., Erie, Pa., U.S.A.

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Please send me further information regarding AMERIGEAR COUPLINGS with the Patented Fully Crowned Tooth Form as described in Catalog No. 501 and Bulletin 1052.

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Please attach to your business letterhead.

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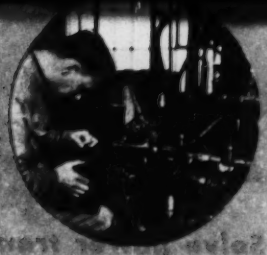
Short-Duration, Repetitive Flashes

STOP or SLOW motion

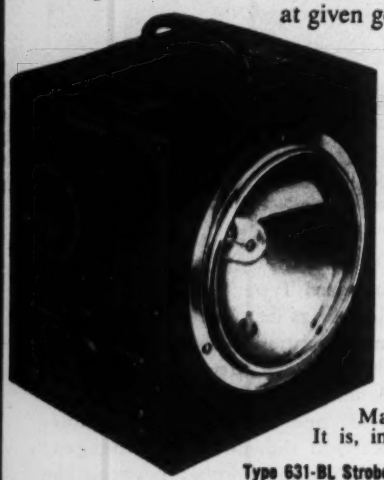
from 60 to 100,000 RPM!



Thousands of Strobotacs are used for . . . observing the operation of fans, printing presses, impact wrenches, valves in action, vacuum cleaners, power wood-saws, oil burners, sewing machines, high-speed rotating seals in jet engines, tape recorders, phonograph motors, grass cutters, hydraulic pumps, belt conveyors, mechanical samplers, electric hammers, automatic washing machines, window air-conditioners . . . . . and for studying gear operation, "surge" in springs, duration of fuel injection in diesels, flywheel "wobble", cam and claw operation in movie projectors, vibratory flexing of structures during dynamic fatigue testing, operation of refrigeration compressors, gyro flight instruments and automatic pilots, functioning of brushes and commutators, . . . and countless other applications.

G-R Stroboscopes are used by manufacturers the world over to engineer their products properly and to improve manufacturing operations.

They are used by production personnel in textile mills to keep spindles operating at uniform speeds . . . in foundries for accurately controlling the rpm of centrifugal machines turning our jet-engine castings . . . aircraft manufacturers use G-R Stroboscopes to measure resonant frequencies and vibration characteristics of equipment prior to installation . . . trucking and bus lines find these instruments invaluable for setting motor speeds at given governor settings.



STROBOTAC®

is the most basic of the G-R line of stroboscopes. By simply directing the flashing light at a rapidly moving part or mechanism, the object can be made to "stand still" or appear to go through its cycle in s-l-o-w motion. Revolving, reciprocating or vibrating machine parts may be examined in detail while actually going through their cycles at full speed.

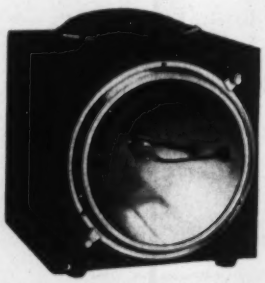
The Strobotac is a portable and easily-operated instrument useful in a wide variety of jobs . . . Design . . . Production . . . Maintenance . . . or Sales Demonstration. It is, in addition an accurate electrical tachometer.

Type 631-BL Strobotac . . . $150.

- ★ Range is direct reading from 60 to 14,400 rpm — speeds up to 100,000 rpm can be measured by use of multiple images
- ★ Only one control — knob calibrated in rpm adjusts flashing rate to desired value — dial readings accurate to ±1%
- ★ Short flash gives sharp images — flash duration is 5 to 10 millionths of a second.
- ★ Inaccessible places can be readily reached for speed measurements or study of motion
- ★ Ideal tachometer — no electrical or mechanical connection with object — no power taken from device whose speed is being measured
- ★ Completely self-contained — operation is from ordinary 115v a-c power
- ★ Dimensions are 7½ x 8¾ x 9⅞ inches — net weight is 9½ pounds

Type 648-A STROBOLUX®

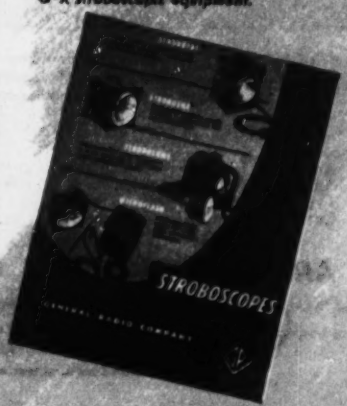
provides a light intensity 100 times that of the Strobotac — with a flashing rate up to 6000 per minute — complete with all connecting cables, $225 — unit must be used with Strobotac, supplied at additional cost.



Type 1532-B STROBOLUME

has high-intensity flash 4000 times as intense as Strobotac's — ideally suited for study of moderate speed mechanisms — flashing rates up to 1200 flashes per minute for short periods; at reduced intensity, up to 3000 per minute — flash rate controlled by the 631-BL Strobotac & Transformer Cable, by the G-R Type 1535-B Contactor or by any other simple make or break contactor — pushbutton provides manual flash control for single-flash photography and other applications — 10 ft. cable between removable lamp housing and power supply enables reaching otherwise inaccessible places . . . Price is $265 for Strobolume alone.

Write for the G-R STROBOSCOPE BULLETIN for complete information on all G-R stroboscopic equipment.



Measurements for Noise Reduction

Increasingly Important to . . .

- **Manufacturers** interested in improving industrial equipment, household appliances and other products.
- **Industrial Hygienists** concerned with dangerous sound levels in plants, offices, subways and city streets.
- **Doctors and Psychologists** concerned with the physiological effects of sound.
- **Salesmen** who find they can "sell" by proving their line is less noisy and consequently less objectionable than competing products.

Type 1555-A **Price: $135**

The Sound-Survey Meter is a pocket-sized and completely self-contained instrument which has a wide field of application. It is smaller, lighter in weight, easier to use and far less costly than sound-level meters used in exacting research and development. It is more than adequate for industrial measurements.

Some of the Sound-Survey Meter's uses include: study of machinery noises, checking sound-levels in setting up public address systems, deafness-risk surveys in plants and offices, and acoustic demonstrations in high schools and colleges.

The Sound-Survey Meter will measure sound-pressure levels ranging from a whisper to the blast of a jet engine (40 to 136 db). Its accuracy, stability and frequency response are remarkable for an instrument of its size and cost. Only two controls on the face of the instrument permit operation by anyone.

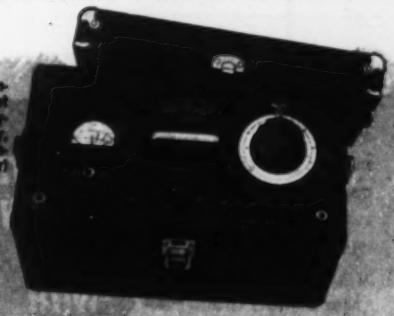
Detailed study of sound, leading to the reduction of noise, requires measuring instruments which are sensitive and reliable. For this purpose, the General Radio Company provides a complete line of sound and vibration measuring instruments . . . instruments based on experience accumulated in 20 years of pioneering in the design and manufacture of commercial sound-level meters and analyzers.

Thousands of these instruments are now in use. They are accurate, light weight, portable and completely self-contained. These equipments are the accepted acoustic measurement standards. Each conforms in every particular with the specifications established by the Acoustical Society of America, the American Standards Association and the American Institute of Electrical Engineers for measuring equipment of its type.

For more exacting sound measurements, G-R offers the Type 1551-A Sound-Level Meter, several analyzers and vibration measuring equipment, as well as various accessories to suit all measuring requirements. Our engineers will be glad to advise which instruments will be most beneficial for your purposes.

Type 1551-A Sound-Level Meter — the basic instrument of the G-R sound measuring line — accepted the world over as the standard for sound measurements — measures directly the sound-pressure levels at its microphone — range is 24 to 140 db above .0002 abar — widely used with G-R Type 760-B Sound Analyzer or Type 1550-A Octave-Band Noise Analyzer for detailed analysis of frequencies present — many operating conveniences provided — Price, $360.

Type 1550-A Octave-Band Noise Analyzer for wide-band measurements — measures prevalence of broad frequency bands rather than of discrete components — noises with complex frequency spectra are rapidly and accurately measured — widely used for frequency analysis of industrial machinery and vehicle noise as well as for ascertaining frequency bands contributing most to speech interference — frequency range is 20 to 10,000 cycles; dynamic range is 65 db — Price, $535.



Type 760-B Sound Analyzer, measures the amplitude of each frequency component present in the sound under study. Invaluable for studying or tracing sources of noise in machinery, appliances, office equipment and other mechanisms (must be used with Sound-Level Meter) — Price, $520.

Type 791-A Vibration Meter, $490 (at right) and **Type 762-B Vibration Analyzer**, $565 (similar to 760-B above) — these instruments are comparable to the sound-level meter and analyzer except that a vibration pickup is supplied for translating the mechanical vibrations to electrical signals for amplification and indication on the panel meter — displacement, velocity or acceleration may be measured over a 2 to 500 cycle range — Analyzer provides both narrow and broad-band analysis selected by panel switch.

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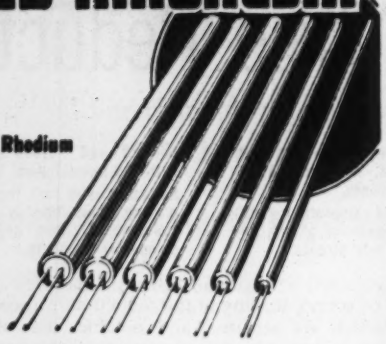

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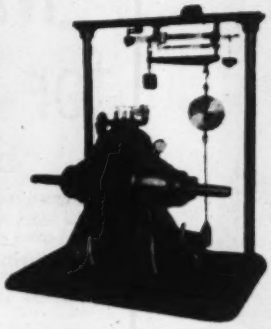
Hydraulic Dynamometers



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EXACT PERFORMANCE DATA

on prime movers

HI-EFF

Write for Bulletin No. 760

You can depend on the performance data taken from a Taylor "HI-EFF" Hydraulic Dynamometer. Efficient, compact Taylor "HI-EFF" offers the most economical investment and maintenance cost per hour. 72 different capacity models each with wide range of h.p. and speed. Capacities from fractional to 10,000 h.p. Speeds from 0 to 25,000 r.p.m. Reversible if desired. Taylor engineers will be glad to make recommendations.

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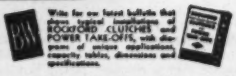

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ROCKFORD CLUTCH DIVISION
BORG-WARNER
1307 Eighteenth Avenue, Rockford, Illinois

ROCKFORD CLUTCHES

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J. H. H. VOSS VALVES
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Our detailed proposal for increasing the efficiency of your compressor will be sent you without obligation. Send us the name, bore, stroke, and speed of your machine.

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Sizes, 6" through 36". Thicknesses 14 gage through ¼".
All types of end joints, fittings and fabricated assemblies.

See your Taylor Forge Distributer for up-to-the-minute facts.

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS • General Offices and Works:
P.O. Box 485, Chicago 90, Illinois • Offices in all principal cities
Plants at: Carnegie, Pa.; Fontana, Calif.; Gary, Ind.; Hamilton, Ontario, Canada

Taken in 1905...

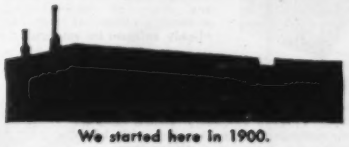
This faded photo was snapped five years after Taylor Forge started back in 1900. That line-up of old timers were putting on a convincing demonstration of the first Taylor Forge product—"Taylor's Spiral Riveted Pipe."

The clothing and hat styles may be dated, but not the pipe. Taylor Spiral Pipe (now welded instead of riveted) then was, and still is, the strongest pipe of its weight.

But while the pipe itself proved revolutionary, the only flanges then available for it—cast iron flanges—were not up to the standard of the pipe. The iron flanges often cracked and caused trouble...and since Taylor Forge couldn't *get* better Flanges, Taylor Forge decided to *make* better flanges.

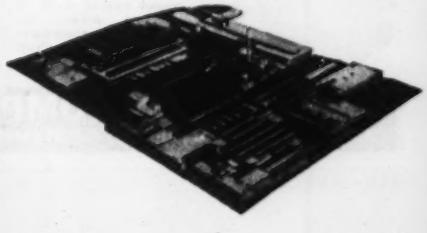
So in that long-ago Taylor Forge set up facilities for making forged steel flanges. It was a pioneering step ...the first time forged steel flanges had been made on a commercial scale. It was also a turning point...for it marked the transition from simply making pipe into the field of *designed* piping.

An episode in the story of Taylor Forge leadership in designed piping



We started here in 1900.

One of the five Taylor Forge plants of today is shown below.



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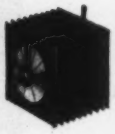
Have almost unlimited use wherever a-c to d-c power conversion is required. Efficient—low cost—require no warm-up.



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Automatically feed small parts of almost any shape or material—single file—in oriented position—at controllable speeds. Highly efficient for automation set-ups.

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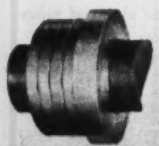

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This Manual recommends the general basis for consulting work, classifies consulting services, deals with designation of mechanical engineering projects, cost of rendering service, types of service, basis for making charges, repetitive work, drawing and designs, patterns and confidential data.

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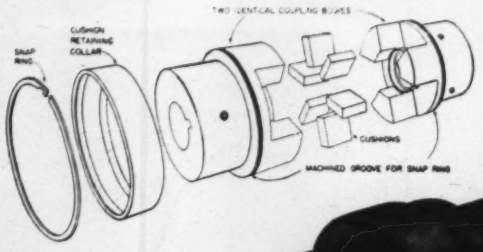

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If you desire capital or have it to invest; if you have a patent for sale or development; if you have on hand used machinery for disposal, or if you want such equipment; if you have copies of publications, or a set of drawing instruments to dispose of; if you need help or want a position, in fact anything to be offered that somebody else may want, or anything wanted that somebody else may have—*use a classified advertisement in the Opportunities Section.*

RATES

Classified advertisements under this heading in MECHANICAL ENGINEERING are inserted at the rate of $1.70 a line, $1.35 a line to members of ASME. Seven words to the line average. A box number address counts as one line. Minimum insertion charge, 3 line basis. Display matter carried in single column units of multiples of one inch at the flat rate of $28 per inch per insertion. Copy must reach us not later than the 10th of the month preceding date of publication.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
29 West 39th Street, New York 18, N. Y.

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Opportunity for an engineer to fill responsible position in the design of automotive instruments, industrial temperature gages, recorders and controllers. Should have about 10 years' experience and will have the responsibility of handling redesigning of present products and the designing of new units to be added to the line of automotive and aircraft instruments.

Junior ENGINEERS • FOR INDUSTRIAL AND AUTOMOTIVE INSTRUMENTS

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THE ELECTRIC AUTO-LITE COMPANY
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with sliding scale range 12" to 120"

This instrument is the very finest sliding scale Manometer. Extremely accurate measurements are assured by the sliding scale feature; no possibility of error due to adding readings of the two legs.

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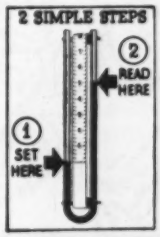

Write for bulletin 40-B

Visit our Booth 824 at the instruments Show in Philadelphia Sept. 13-24

Trimount Model 40
INSTRUMENT COMPANY
3119 WEST LAKE STREET • CHICAGO 12, ILLINOIS

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A 20-PAGE LIST OF ASME PUBLICATIONS

is included in the

1954 MECHANICAL CATALOG

Copies of the List are obtainable from

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Publication-Sales Dept.

29 West 39th St., New York 18, N. Y.

MECHANICAL ENGINEERING, 29 W. 39th St., New York 18, N. Y.

Additional information is requested on the following advertisements in the August 1954 issue

Page No.	*Name of Advertiser*

Name _____ Title _____

Company _____

Address _____

City _____ State _____

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Go through the advertising pages and jot down the page numbers and names of advertisers about whose product you want additional information — mail the coupon to us — your request will be passed on to the advertiser promptly — you will hear directly from advertiser — saves your time in writing individual letters.

Keep Heat Transfer Surfaces CLEAN...

*DOUBLE PIPE UNIT. Drive end close-up of 12 section unit under test in our shop.

*SHELL and PIPE UNITS. Two of five units installed in a leading petroleum refinery.

*Patented

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Vogt

SCRAPED SURFACE *Exchangers*

IF you are all "gummed up" with a tough heat transfer problem, Vogt Scraped Surface Exchangers will provide the answer. They have patented scraper elements which prevent fouling of the heat transfer surfaces and insure the highest rate of heat exchange between the product and the cooling or heating medium. The scrapers also continuously agitate the fluid and assist removal of solids from the unit.

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SHELL AND PIPE TYPE UNITS are designed for use with volatile refrigerants and for heating fluids with steam or similar heating mediums. They consist of large welded shells each containing seven 6" scraped pipe sections.

Vogt Scraped Surface Exchangers serve profitably as oil chillers, crystallizers, and heaters in many processes in the petroleum and chemical industries. Their application to your heat transfer problems will receive the prompt attention of our Engineering staff.

Write for Bulletin PE-1

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Positions Open—Positions Wanted—Equipment, Material, Patents, Books, Instruments, etc. Wanted and For Sale

Answers to box number advertisements should be addressed to given box number, care of "Mechanical Engineering," 29 West 39th St., New York 18, N. Y.

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RATES Classified Advertisements under this heading in MECHANICAL ENGINEERING are inserted at the rate of $1.70 a line. $1.35 a line to members of ASME. Seven words to the line average. A box number address counts as one line. Minimum insertion charge, 5 line basis. Display Advertisements carried in single column units of multiples of one inch at flat rate of $28 per inch per insertion. Copy must reach us not later than the 10th of the month preceding date of publication.

MECHANICAL ENGINEER

Internationally known research organization seeks an outstanding mechanical engineer to work on a challenging development program in the chemical munitions field.

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This is a long-term assignment on the East Coast. We will assume the cost of moving and transportation expenses for you and your family. Send resumé to:

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Qualified Electrical and Mechanical Engineers and Physicists needed in the following fields:

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Liberal salaries and benefits.

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Box 308-W
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Employee Relations Manager
Research and Development Department

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Bartlesville, Oklahoma

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Major Petroleum Company has excellent opportunity in Engineering and Construction Department for number 2 man in Drafting Division of approximately 90 people. Must be graduate engineer (preferably Mechanical) with demonstrated ability to direct and coordinate work of drafting groups. Should have at least 10 years' experience with all phases of design, layout and drafting. Must be familiar with engineering calculations, specifications, materials, codes and engineering and construction methods, with emphasis on process piping, pressure vessel, mechanical, structural, electrical, architectural and instrument work. If you are now earning in the neighborhood of $10,000 and looking for a real opportunity to advance, send résumé in confidence to Mr. H. M. Overley, P. O. Box 7258, Philadelphia 1, Pa.

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The Tennessee Valley Authority needs an experienced boiler feed-water control engineer for high-pressure, high-temperature steam plants in its Division of Power Operations located at Chattanooga, Tennessee. This is a staff engineering position. Salary range, $4735–$6575, depending upon training and experience. Applicants must have a college degree in Chemical Engineering or equivalent. Retirement benefits, annual and sick leave, 40-hour week.

Write to the
Tennessee Valley Authority
Division of Personnel
Knoxville or Chattanooga, Tennessee

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New Research and Development plans and promotions have created openings for several engineers.

Most openings are for engineers with less than five years' Experience.

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Telephone: Linden 4-0393

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Our expanding staff assures permanent positions and excellent opportunities for personal and professional growth in

RESEARCH AND DEVELOPMENT

Weapon System Evaluation

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Chicago 16, Illinois

hydraulics engineers

Honeywell's expanding Aeronautical Division has unusual openings for qualified men in the field of precision hydraulic equipment. If you are interested in a permanent position in the aeronautical control field with America's largest control manufacturer consider these challenging opportunities now available at top salaries.

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New position open in the design of precision hydraulic servos, valves, actuators and other hydraulic products as applied to jet engine control systems. Required ME degree or equivalent. Experience in design with emphasis on reduced cost of production especially pertinent.

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Unusual newly created position in research involving studies in control valve configurations, acoustical phenomena in hydraulic systems, silting and fluid contamination and related subjects. Also will act as consultant to engineering department. Requires ME degree or equivalent with background of advanced training in hydraulic control areas.

If you are interested in any of these well paid positions located in Honeywell's new Aeronautical plant in Minneapolis, send your resumés to:

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Director of Engineering Placement
Dept. ME-8
Minneapolis-Honeywell Regulator Co.
Minneapolis 8, Minnesota

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First in Controls

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Design and develop printing telegraph and related communication equipment.

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To analyze customer needs, review existing techniques, establish design approach for new products, and develop sound designs for manufacture.

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To develop switching, storage and similar circuitry. Should be trained in communications and electronic circuits and possess broad interest in Mechanical as well as Electrical Engineering.

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Attention: Employment Department

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mechanical engineers

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A General Electric career offers many advantages to ambitious and creative engineers:

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PLUS

pensions . . . life insurance . . . paid vacations . . . surgical and hospitalization benefits . . . educational subsidies . . . and others.

Write: Technical Personnel

GENERAL ELECTRIC

P.O. BOX 1122 SYRACUSE, N. Y.

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Write Section B
Engineering Personnel Office

NORTH AMERICAN AVIATION, INC.
5601 W. Imperial Hwy.
International Airport
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DEVELOPMENT ENGINEER

Mechanical or Aeronautical Engineer for Engineering Research and Product Development. Company specializes in the design, production and application of vibration isolators, flexible couplings and rubber bonded to metal assemblies. Excellent laboratory and working conditions with a wide variety of problems in military and commercial fields.

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AAA-1 Manufacturer of bearings requires SALES ENGINEER to locate near Washington, D. C., and cover certain areas to the south and north of Washington. Mechanical engineering degree preferred; considerable traveling necessary. Company furnishes car. Address CA-4720, care of "Mechanical Engineering."

Additional Opportunities are offered in the display advertisements—on pages 47, 48, 52, 56, 98, 116, 117

POSITIONS WANTED

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MECHANICAL ENGINEER—31, B.S. Degree, Registered. Experienced in product design, research, testing and liaison work with light to medium heavy precision equipment. Desires lead position with small progressive firm. Address CA-4767, care of "Mechanical Engineering."

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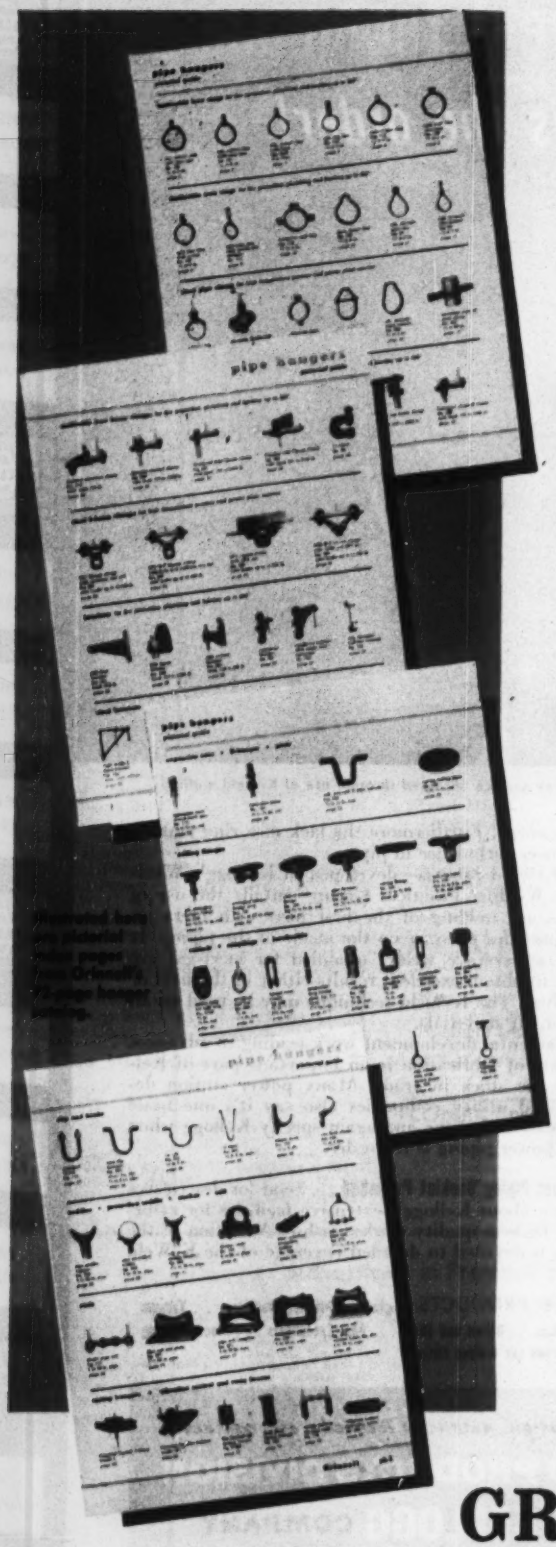

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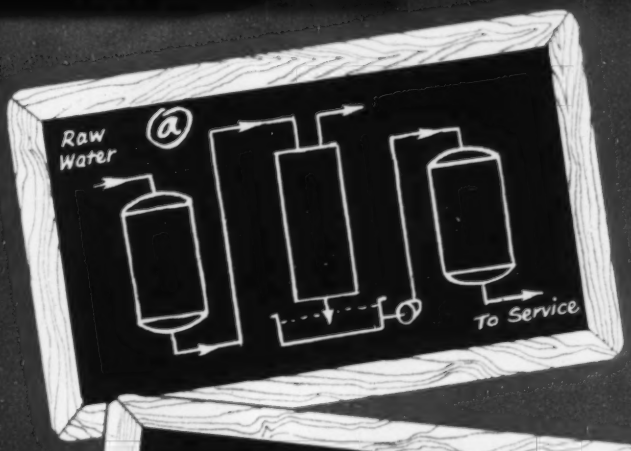

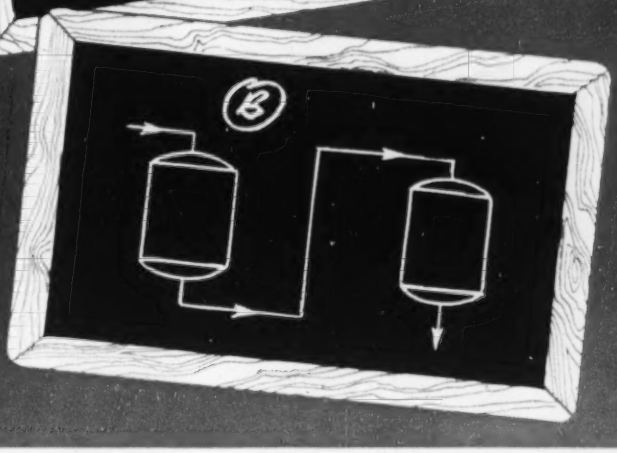

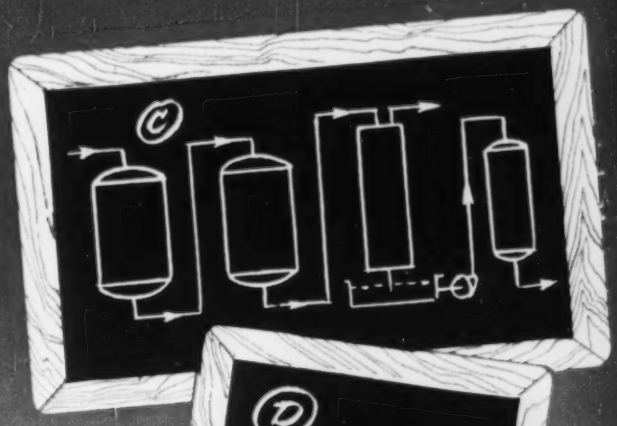

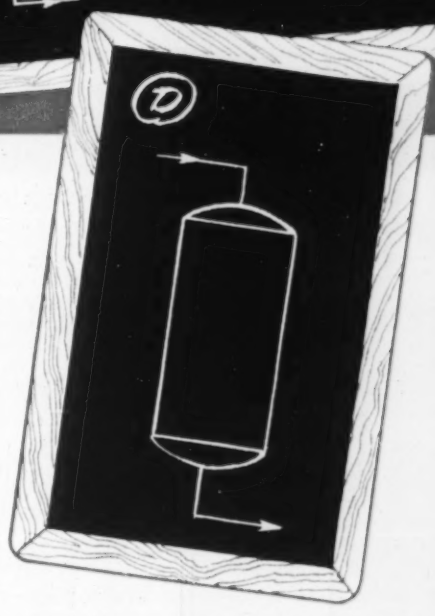

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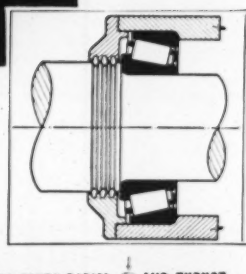

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